Canadian Cow-Calf
Adoption Rates and Performance Levels Report

Developed for the Beef Cattle Research Council by Canfax Research Services

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EXECUTIVE SUMMARY

The Five Year *Canadian Beef Research and Technology Transfer Strategy* highlights the objective to measure and monitor the adoption of innovations by compiling known adoption rates through existing data collection methods, while enhancing the measurement of adoption levels where feasible (Beef Cattle Research Council, 2021). The Beef Cattle Research Council (BCRC) continues to support this goal by working collaboratively with provincial and national stakeholders through the Canadian Beef Knowledge Mobilization Network.

As Canadian beef producers have little influence over market prices, they often seek ways to improve efficiencies through cost savings and increased herd productivity to remain viable. Adopting practices, technologies, or performance benchmarks can help producers achieve their operations' environmental, animal health and welfare, or financial goals.

The practices, technologies, and performance benchmarks included in this report are monitored to refine priorities for research and knowledge mobilization activities. However, it is recognized that blanket statements around practices being "beneficial" for all producers may be misleading. One producer may find a practice to provide cost savings and support profitability, while another producer with a different management may find that same practice to add costs and reduce profitability. This means that no practice is expected to have 100% adoption.

This report updates the BCRC 2019 Adoptions Rates of Recommended Practices by Cow-Calf Operators in Canada Report using data from the 2022-23 Canadian Cow-Calf Survey (CCCS) (CCCS, 2024), 2021 Census of Agriculture (COA) (Statistics Canada, 2022a), 2021 Farm Management Survey (FMS) (Canfax Research Services (CRS), 2022a, 2022b, & 2024), and relevant academic studies. It should be recognized that all survey results are subject to volunteer bias and are not representative samples of the industry. Hence, the adoption rates and performance levels presented here may be higher than actual values, due to the tendencies of more engaged or progressive producers who participate in surveys. Studies using actual operational data, though more reliable, are subject to sample bias in farm selection. This bias, however, does not invalidate the results, as participating producers offer a useful trend for guiding industry knowledge mobilization efforts.

SUGGESTED KNOWLEDGE MOBILIZATION PRIORITIES BY REGION

This report provides an overview of adoption trends and performance levels for 31 practices across reproductive management, calf health, herd management, forage utilization, environmental stewardship, and record-keeping. Each section includes a perceived status, trend, barriers, resources, and opportunities. The perceived status is a subjective category determined by the authors, reflecting their general understanding of a practice's adoption or performance. This determination incorporated an evaluation of current and historical levels, regional suitability, and attractiveness to diverse management systems (Table 1, see *Appendices* for data details). The six perceived status categories are:

Close to peak adoption or performance. These are performance levels, practices or technologies that have gained widespread traction among producers, with stable trends and broad awareness. But as new producers enter the industry, ongoing communication is required to maintain adoption rates. This includes open rates, pregnancy checking, unassisted calving, dehorning/castration at an early age, herd vaccination, grazing management, and record keeping.

***Decreased adoption or performance driven by weather, markets or information*.** Lower adoption rates for practices can stem from environmental or economic pressures, the emergence of new information, or the availability of alternatives. A prime example of this is extensive winter feeding, which is the sole practice currently in this category. Its reduced adoption could be influenced by factors such as prolonged drought, the use of alternative feedstuffs, prevailing pasture conditions, or other relevant considerations. At this stage, it's a trend that warrants close monitoring to ascertain if improved weather conditions will lead to a reversal.

TABLE 1. OVERVIEW OF PRACTICES, CURRENT CATEGORIZATION, AND TRENDS

Practice	West	East
Close to peak adoption [a]		
Open rates	↔	↓
Calving distribution	↑	e
Pregnancy checking	↔	↔
Unassisted calving	↑	?
Breeding soundness exams and reproductive diseases	↔	e
Recommended calf resuscitation	↔	?
Dehorning/Castration – pain mitigation	↑	↑
Vaccination	↔	↔
Parasite management [f]	↔↓	↔↓
Grazing management	↔	↔
Forage rejuvenation	↔	↔
Record keeping	↑	↔
Decreased adoption [b]		
Extensive winter feeding	↓	↓
Low adoption [d]		
Calving distribution	e	↓
Implanting	↑	↑
Growth - weaning weights	↓	↔
Water testing	↓	↔

Practice	West	East
Improving, but low adoption [c]		
Body condition scoring	↔	?
Replacement heifer management	↔	↔
Breeding soundness exams and reproductive diseases	e	↑
Early life interventions	?	?
Calf mortality	↓	↔
Harmful calf resuscitation	↓	?
Low-stress weaning	↔	↔
Veterinary communication	?	?
Feed testing and ration balancing	↔	↑
Mineral supplementation	↔	↔
Winter feeding manure management	↔	↔
Recycling twine/plastics	↑	↑
Emerging or underserved		
Cover crops/Intercropping [f]	↔↑	↔↑
Manure testing	↔	↔
Niche practices		
Retaining ownership	↓	?
Breeding technologies [f]	↑	↔↓
Remote drug delivery	?	?

↑ *The trend is increasing, a desirable outcome (e.g. unassisted calving)*

↑ *The trend is increasing, an undesirable outcome (e.g. death loss)*

↔ *The trend is stable*

↓ *The trend is decreasing, a desirable outcome (e.g. calving season length)*

↓ *The trend is decreasing, an undesirable outcome (e.g. parasite control)*

? *The trend is uncertain due to insufficient data*

[a] *Support existing adoption with regular communications;* [b] *Driven by weather, markets and information;* [c] *Increase depth of adoption;* [d] *Could be targeted with knowledge mobilization materials;* [e] *trend is located in another perceived status section of this table;* [f] adoption of individual practices vary within these overarching categories (e.g. use of winter cover crops is steady, but the use of companion crops is increasing).

Other practices such as hands-on body condition scoring (BCS), replacement heifer management, reducing calf mortality within 24 hours of birth, low-stress weaning, feed testing and ration balancing, mineral supplementation, and manure management during winter feeding show ***improving adoption or performance levels*** but are still relatively low. There is evidence of widespread awareness of these

practices or technologies among Canadian cow-calf producers, but they are not applying them to their full potential or observed performance levels are below benchmarks. Geographical, regional, infrastructure accessibility and financial barriers may prevent broader adoption or improvements. Producers would benefit from the development of creative solutions to address these barriers. These practices and technologies could see increased depth of adoption and performance by providing a broader range of benefits for different management systems. For example, adoption of BCS is high for visual assessment, but it is much lower for hands-on assessment. Communicating the practical benefits to producers of hands-on assessment is necessary to shift practices.

Other practices have ***low adoption or performance*** and may face significant regional or economic barriers. Within this category there are multiple related practices. Weaning weights have under-performed as a percentage of mature cow weights, indicating that there is more genetic potential that could be utilized for the cow-calf producers' benefit. Known practices to support weaning weights include water systems management, water testing, the use of implants, and rotational grazing. For example, calves with access to clean, pumped water are, on average, 18 lbs heavier at weaning (Lardner et al., 2005). This is because clean water supports animal health by preventing fecal contamination. Additionally, cattle that drink more also tend to eat more, which further supports weight gain. These practices could be targeted with knowledge mobilization materials.

Emerging or under-served topics are practices or technologies where research hasn't yet provided clear recommendations to producers. Examples include cover crops, intercropping, and manure testing. Effective knowledge mobilization is needed to inform producers of new information and gaps in knowledge to be addressed through research.

Niche practices or technologies that are only suitable for specific operations and herds, includes breeding technologies such as artificial insemination and embryo transfer, retained ownership, and remote drug delivery (RDD). It is recommended that knowledge mobilization resources be available for producers to learn about these practices, and for adoption to be monitored.

INTRODUCTION

The Five-Year *Canadian Beef Research and Technology Transfer Strategy* published in 2021 has the objective to measure and monitor the adoption of innovations by compiling known adoption rates through existing data collection methods, while enhancing the measurement of adoption levels (BCRC, 2021). The BCRC commissioned the inaugural 2019 *Adoption Rates of Recommended Practices by Cow-Calf Operators in Canada* (BCRC, 2019a), where the aim was to amalgamate data from several sources to estimate adoption rates at national, regional, and provincial levels on a wide range of practices. Many practices and technologies have been recommended for beef cow-calf producers to improve productivity, reduce costs, increase profitability, and improve stability at the farm-level and for the Canadian beef sector as a whole.

This report updates the 2019 report (BCRC, 2019a) using data from the 2022-23 CCCS (CCCS, 2024), academic studies, 2021 COA (Statistics Canada, 2022a), and 2021 FMS (CRS, 2022a, 2022b, & 2024; Statistics Canada, 2022b). This report aims to support knowledge mobilization staff across Canada by detailing changes in practice adoption and offering insights for future efforts in disseminating knowledge on best practices. For each practice-specific section, it provides a perceived status, trend, barriers, resources, and opportunities. The perceived status is a subjective category provided by the authors, and may vary by region. The reader may have a different perspective on status of individual practices based on their own experience or from interactions with other producers.

A key change from the preceding 2019 adoption rates report is the removal of "Recommended Practices" from the title. The practices included in this report are being monitored to refine priorities for research and knowledge mobilization activities. These practices may have been previously recommended by research or industry communications for reasons related to animal welfare, animal health, environmental impact, productivity, or profitability purposes. However, it is recognized that blanket statements around practices being *beneficial* for all producers may be misleading. A single practice might offer cost savings and boost profitability for one producer yet increase costs and reduce profitability for another with a different management approach. No practice is expected to reach 100% adoption. For instance, herd vaccinations remain steady at 94%, as an estimated 6% of producers are philosophically opposed. Peak adoption occurs when the practice has been widely adopted by operations for which it makes economic or environmental sense, aligns with producers' values, and the adoption rate has stabilized. Given Canada's diverse climates and ecoregions, adoption and peak adoption can vary significantly from west to east and north to south. Within a province, adoption can differ based on various factors such as operation size, winter feed provision, and access to pasture.

It should be recognized that there are diminishing returns from adopting certain practices beyond a certain threshold, even within individual operations. For example, the cost-benefit for improving conception rates from 90% to 95% may be positive, but increasing conception rates above 95% may come at a net cost. Determining realistic adoption levels for each practice is challenging, as it requires understanding the specific barriers for different regions and types of operations within those regions.

Production and management practices often change in response to market signals and environmental factors like drought, flood, and fire. These shifts contribute to variations in animal performance and raise concerns such as feed quality and the need for feed alternatives. Therefore, results should be considered within the whole context of the industry at the time of data collection.

Decision making tools and calculators can help inform knowledge mobilization staff about the pros and cons of each practice so that discussions with producers can be valuable even if they aren't completely

tailored to each operation. It should be recognized that some practices are not conducive to decision making tools or calculators.

This report contains a substantial amount of technical data, as it is essential to analyzing adoption rates. For more detailed information on specific topics, readers are encouraged to consult the 2019 Adoption Rates report.

AVAILABLE DATA SOURCES

The 2021 *COA*[1] and the 2021 *FMS* are Statistics Canada's most comprehensive data sources for both livestock and crop operations. While the COA collects data from all agricultural operations in Canada, the FMS uses a representative sample. Despite offering substantial sample or population data, the COA and the FMS are generally limited to broad demographics and a narrow selection of production practices.

With 600 responses, the 2022-23 CCCS serves as a key data source for estimating the adoption rates of the majority of practices discussed in this report (CCCS, 2024). The 2014 and 2017 *Western Canadian Cow-Calf Surveys* (WCCCS and WCCS II, respectively, Western Beef Development Centre, 2015; University of Saskatchewan, 2018), *Ontario Cow-Calf 2017 Production Survey* (OCCS, University of Guelph, 2018), and the *2017 Atlantic Cow-Calf Survey* (ACCS, Maritime Beef Council, 2018) were used extensively in the 2019 BCRC Adoption Rates report, with a combined 508 responses across the country (BCRC, 2019a). Although not identical, the consistent methods - especially in question format and presentation of results - make these surveys useful for time-series analysis alongside the 2022–23 Canadian Cow-Calf Survey (CCCS). The *Alberta AgriSystem's Living Lab* (AALL) *Adoption Rates Survey* (AALL, 2024) also provides a regional breakdown of crop-livestock integrated practices within the province.

Like all surveys, these results are subject to self-selection bias and may not fully represent all producers in the industry. Adoption rates in this survey could be higher or lower than actual industry averages, depending on the types of producers who responded. It is encouraging that response rates in the 2022-23 CCCS were consistent or higher compared to regional surveys conducted between 2015 and 2017 (CCCS, 2024).

While studies using on-farm, audited animal-level data are generally more reliable, they still face volunteer bias based on which farms choose to participate. However, this does not invalidate the findings. Producers who take part in surveys and studies help identify trends that can guide the industry's efforts in sharing knowledge and improving communication. Table 2. Cow-calf survey details summarizes the surveys used as data sources for the analysis in this report. The reader should note there is generally a gap between the year the data was collected and the year the survey results were published. Published academic literature on livestock management are used to supplement information extracted from the sources listed in Table 2. The literature also provides insight on the barriers and incentives for adopting various management practices. Questions regarding adoption barriers are not always included in larger surveys but are important to understand where adoption of specific practices could be improved or where it may have peaked. Producers generally adopt practices when there is a tangible or perceived financial, environmental, and/or social benefit (Jelinski et al., 2019). The social aspect can often be more nuanced than financial or environmental benefits and can be particularly useful for knowledge mobilization efforts (e.g., social stigma attached to certain practices).

[1] For the 2021 Census of Agriculture, the reference date was set to May 11, 2021. https://www150.statcan.gc.ca/n1/pub/32-26-0002/322600022021001-eng.htm

Table 3 summarizes additional sources of data and information, distinct from cow-calf operations management surveys, used in the analysis of this report.

TABLE 2. COW-CALF SURVEY DETAILS

Survey	Production year	Responses	Reference Publication
Canadian Cow-Calf Survey (CCCS)	2022-23	600	CCCS, 2024
Alberta AgriSystems Living Lab Survey (AALL)	2022	312	AALL, 2024
Western Canadian Cow-Calf Survey (WCCCS II)	2016-17	261	University of Saskatchewan, 2018
Atlantic Cow-Calf Survey (ACCS)	2016-17	65	Maritime Beef Council, 2018
Ontario Cow-Calf Production Survey (OCC)	2015-16	83	University of Guelph, 2018
Northern Beef Study (Ontario and Québec)	2015-16	99	Lamothe and North Haven Solutions, 2018
Western Canadian Cow-Calf Survey (WCCCS)	2013-14	411	Western Beef Development Centre, 2015
A questionnaire on the health, management and performance of cow-calf herds in Québec	1995 calving	330	Dutil et al., 1999
Reproductive Efficiency and Calf Survival in Ontario Beef Cow-Calf Herds	1983	225	Rogers et al., 1985

TABLE 3. OTHER SURVEY DETAILS

Survey	Production Year	Reference Publication
Census of Agriculture (COA), Statistics Canada 2016 and 2021	2016 and 2021	Statistics Canada 2017, 2022a
Farm Management Survey (FMS), Statistics Canada 2017 and 2021	2017 and 2021	Canfax Research Services (CRS), 2017, 2022a, 2022b, 2024
Canadian Cow-Calf Surveillance Network (C3SN)	2018 to 2022	Walder et al., 2024
Vaccine use in Canadian cow-calf herds	2020	Lazurko et al., 2023
Technology adoption and management practices	2020	Lazurko et al., 2024
Update on copper and selenium in Canadian cow-calf regional differences and estimation of serum reference values	2014, 2016, 2019	Waldner et al., 2023
Improving beef calf health: frequency of disease syndromes	2014-15	Waldner et al., 2022
Benchmarking calving management practices in western Canadian cow-calf operations	2016 calving	Pearson et al., 2019
Saskatchewan beef cattle producers on management practices and veterinary usage	2012	Jelinski et al., 2015

For definitions of terms and detailed survey information, readers should consult the full survey reports referenced in this document.

FARM AND PRODUCER DEMOGRAPHICS

Adoption levels are influenced by several factors including demographics (i.e., producer age, education), operation size, access to labour, and clusters of similar technologies and practices. They are also motivated by socio-technical aspects such as learnability, complexity, and access to support services. Financial aspects significantly influence adoption rates, including cost-benefit analysis, initial investment, and the time required to recoup that investment. Additionally, producer values and priorities regarding environmental stewardship, animal welfare, and the utilization of government programs also play a crucial role. The following sections provide a brief overview of the Canadian context on these indicators.

In Canada, 60,697 farms were classified as beef cattle operations in 2021. Notably, the trend of farm consolidation appears to have stabilized in this survey year, following several decades of decreasing farm numbers (Statistics Canada 2016, 2021). The proportion of cow-calf (53,936), stocker (3,087), and finishing (3,674) operations is consistent as reported in 2016 at 89%, 5%, and 6%, respectively.

According to the 2021 COA, most of Canada's beef cattle operators are over age 55; male, or male and female managed; and sole operators (CRS, 2024). The proportion of young producers (those under 35 years of age) in 2021, as per the COA, was 11% and comparable to 2016 reports. However, the geographical distribution has shifted. Alberta, Saskatchewan, and Manitoba have seen an increase in the proportion of young beef producers, while all other provinces have experienced a decrease (Table 4). The proportion of multi-generational farms is highest in Québec (14%) followed by British Columbia (12%). Communication strategies on management practices need to be tailored to better target producers based on their age, how they and where they consume relevant content, and where they seek information.

TABLE 4. AGE OF BEEF PRODUCERS BY PROVINCE

% of Beef Cattle Farms Reporting	Canada	BC	AB	SK	MB	ON	QC	AP
<35 years of age	8.8%	4.3%	9.6%	10.7%	11.4%	6.9%	4.8%	5.2%
35-54 years of age	26.3%	21.3%	26.0%	28.1%	28.6%	25.1%	28.8%	22.5%
>55 years of age	55.0%	62.6%	54.6%	52.3%	50.5%	58.2%	52.4%	62.9%
Multi-generational operators by age								
<35 years & 35-54 years	1.5%	1.7%	1.5%	1.3%	1.5%	1.5%	1.8%	1.3%
<35 years & >55 years	1.5%	1.6%	1.3%	1.3%	1.5%	1.7%	2.6%	1.9%
35-54 years and & >55 years	6.6%	8.2%	6.7%	5.9%	6.2%	6.3%	9.0%	5.9%
<35 years, 35-54 years & >55 years	0.3%	0.1%	0.3%	0.3%	0.3%	0.3%	0.6%	0.3%
<35 years of age (on all operations)	**10.5%**	**6.1%**	**11.4%**	**12.4%**	**13.2%**	**8.7%**	**7.2%**	**6.8%**

Source: Statistics Canada, 2022.

The 2021 Census of Agriculture reported that the uptake of succession planning remains low, with only 11% of beef operations having a written succession plan in place (Table 5) (CRS, 2022c). Of the succession plans that have been written, over 97% of the successor(s) are family members. However, according to the AALL survey, only 13% of producers stated that a family or inner circle member would *definitely* or *very likely* take over the operation in the future (AALL, 2024). Lippsmeyer et al. (2023) found that farms with succession plans tend to have better management practices, while farms without a succession plan may have less organized management, which could make them less willing to try new practices.

TABLE 5. WRITTEN SUCCESSION PLANS FOR BEEF FARMS ACROSS CANADA

Region	Written succession plan, family member successors - Farms reporting		Written succession plan, non-family member successors - Farms reporting	
	2016	2021	2016	2021
Canada	6.6%	10.6%	0.2%	0.3%
MT	4.7%	41.8%	0.2%	0.9%
QC	5.0%	6.2%	0.1%	0.3%
ON	5.4%	8.5%	0.2%	0.3%
MB	5.2%	8.5%	0.3%	0.3%
SK	6.8%	11.2%	0.1%	0.2%
AB	8.2%	13.2%	0.2%	0.4%
BC	5.7%	10.1%	0.3%	0.4%

Source: CRS, n.d. -a

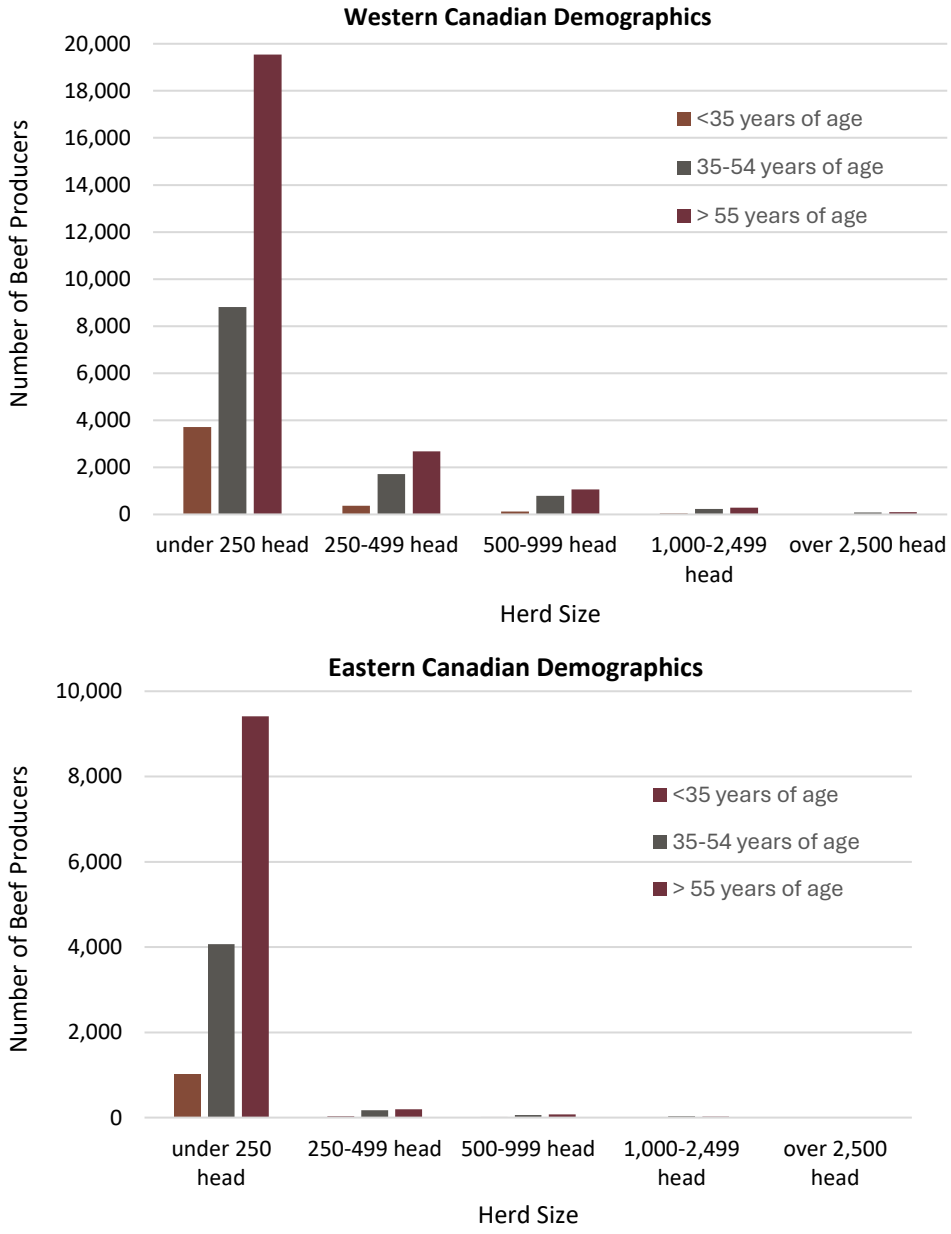
Economies of Scale

Literature suggests that economies of scale and a higher availability of labour may impact the uptake of adoption practices (Jelinski et al., 2019). Messages that highlight the benefits of economies of scale may work well for producers with larger herds, as they can spread overhead costs across more animals. In contrast, producers with smaller herds may be more interested in improvements to individual animal performance and efficiency. This means the same topic needs to be communicated differently to connect with different types of producers. In Western Canada, 81% of farms have fewer than 250 head, while in Eastern Canada, that number rises to 96%, reflecting generally smaller herd sizes (

Figure 1).

Knowledge mobilization efforts that target small operations (i.e., 1-17 beef cows) captures 17,500 producers (33% of all operations) but fewer than 150,000 beef cows (under 5% of the Canadian beef cow herd) (Statistics Canada, 2022a). In contrast, efforts targeting large operations (i.e., over 250 beef cows) captures only 2,700 producers (5% of total operations) but has the potential to impact nearly 1.2 million beef cows, representing 22% of the national herd. Knowledge mobilization efforts must target both groups and communicate in ways that capture the interests and attention of producers with diverse demographics.

FIGURE 1. REGIONAL CANADIAN BEEF PRODUCER DEMOGRAPHICS BY HERD SIZE AND PRODUCER AGE



Source: Statistics Canada, 2022a.

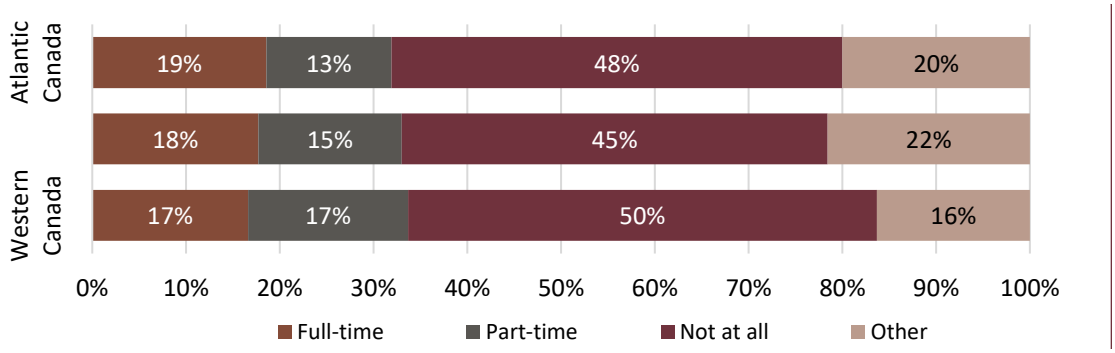
Labour availability has been identified as an issue regardless of herd size or region. Over 50% of operations received off-farm income in 2021 (Table 6). This was similar across Western Canada, Ontario and Atlantic Canada (Figure 2). This means that fewer on-farm hours are available for considering and implementing new practices nationwide. Developing communication practices that reduce the learning or training time, while supporting producer success in their first implementation attempt is key when engaging producers with limited time.

TABLE 6. PERCENTAGE OF CATTLE OPERATORS' TIME CONTRIBUTED TO THE AGRICULTURAL OPERATION

	More than 40 hours /week	30 - 40 hours /week	20 to 29 hours /week	Less than 20 hours /week	Received off-farm income
All age classes	42.2%	16.6%	17.0%	24.3%	50.9%
Under 35 years of age	37.5%	16.9%	19.6%	26.0%	69.5%
35 - 54 years of age	42.3%	15.5%	18.1%	24.0%	63.9%
55 years of age & over	42.8%	17.1%	15.9%	24.1%	40.9%

Source: Statistics Canada, 2022a [2].

FIGURE 2. PROPORTION OF OFF-FARM EMPLOYMENT ACROSS REGIONS



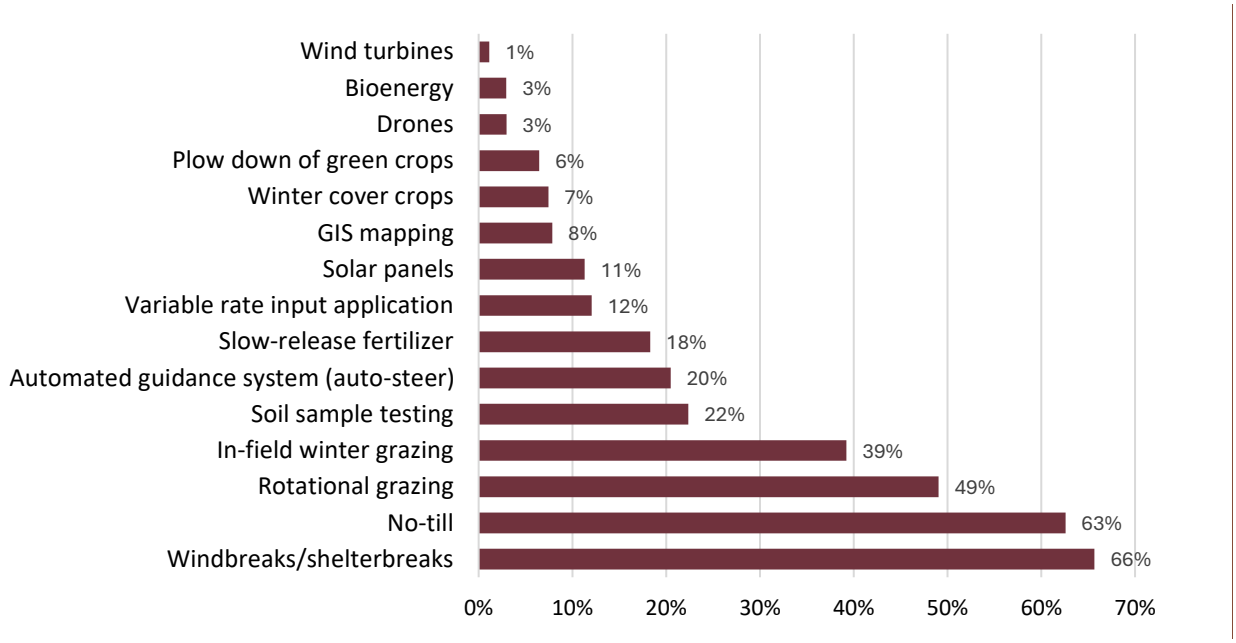
Source: Statistics Canada, 2022a.

Use of Technology

The 2021 COA captures the use of numerous technologies and practices (Figure 3). The adoption of shelterbelts or windbreaks on beef cattle farms increased from 51% in 2016 to 66% in 2021, becoming the most broadly adopted practice (Statistics Canada, 2022a). Compared to 2016, a larger proportion of respondents in the 2021 survey reported adopting GIS mapping, solar panels, and automated steering technologies. Adoption rates were similar between the 2016 and 2021 COA for wind turbines, plowing down green crops, winter cover crops, and rotational grazing (Statistics Canada, 2017, 2022a).

[2] Three demographic categories (under 35 years old, 35-54 years old, and 55 years old and over) represent 90% of Canadian beef producers. The remaining 10% is comprised of a combination of those ages, representing multi-generational farms.

FIGURE 3. ADOPTION LEVELS ON CANADIAN BEEF CATTLE FARMS



Source: Statistics Canada, 2022a.

The 2021 COA data reported 40% of all farms adopted some form of technology, though individual technology uptake ranges from 7 to 21%. This indicates that several operations appear to be adopting multiple technologies (Table 7). New technologies being used on cow-calf farms in Canada include the use of drones and slow-release fertilizer.

TABLE 7. ADOPTION RATES OF TECHNOLOGIES ON COW-CALF FARMS BY FARM SIZE

	Technology used	Auto-steer	GIS mapping	Variable rate input application	Drones	Soil sample test	Slow-release fertilizer
All farms	40%	20%	7%	12%	3%	21%	17%
Under 250 head	35%	16%	6%	10%	2%	19%	16%
250 to 499 head	61%	39%	12%	19%	5%	32%	25%
500 to 999 head	70%	49%	16%	23%	7%	39%	31%
1,000 to 2,499 head	80%	61%	21%	28%	11%	54%	37%
2,500 head and over	84%	58%	38%	46%	16%	70%	35%

Source: Statistics Canada, 2022a.

Cow-calf producers with over 2,500 head (large operations) show higher adoption rates of nearly all technologies (Statistics Canada, 2022a). For example, autosteer is used on 58% of these large operations compared to 20% for all farms. Similarly, GIS mapping is employed on 38% of large operations versus 7% for all farms, and drones are used on 16% of large operations compared to 3% for operations of all sizes.

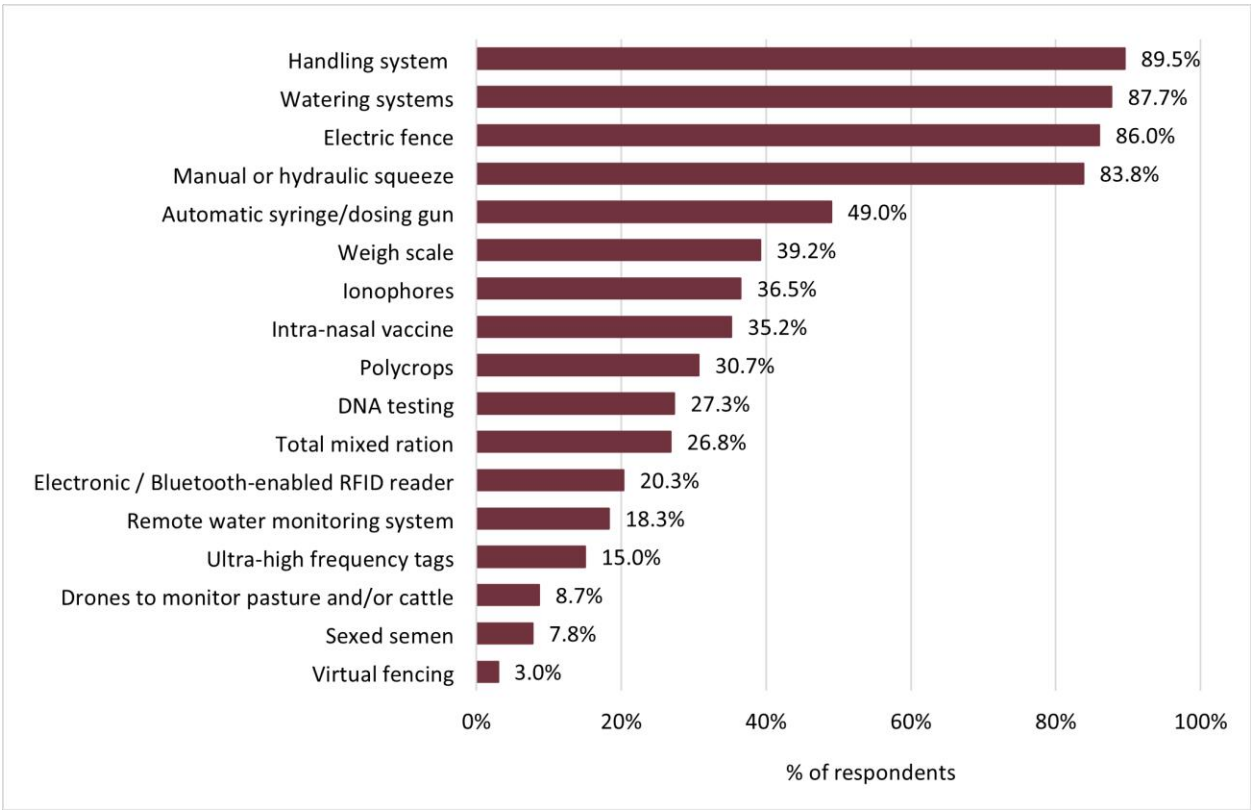
Computer and cellphone use was previously tracked by Statistics Canada, but since these technologies have become nearly universal on all operations, they are not included in the 2021 survey. Lazurko et al.

(2024) found that cameras and remote monitors are used by approximately 45% of producers and drones are used by approximately 10%.

Out of the dozens of technologies investigated by Lazurko et al. (2024), the technologies used at least occasionally included individual female production records (80%), feed testing (84%), and on-farm weighing (76%). Survey participants were part of the *Western Canadian Cow-Calf Surveillance Network* (C3SN) and were leading adopters of recommended practices and technologies.

Selected technology adoption rates from the CCCS (2024) are shown in Figure **4**. Handling and watering systems, electric fencing, and manual or hydraulic squeezes have been implemented on over 80% of farms nationally.

FIGURE 4. TECHNOLOGIES ADOPTED ON OPERATIONS



Source: CCCS, 2024.

A Canadian cow-calf survey done in 2020 by Lazurko et al (2024) found the technologies that had the highest rates of failed adoption included: estrus synchronization (15% currently used from 20-30% previously used) and water testing (18% currently used from 25% previously used). It is hypothesized that time, labour, financial investment, and expertise required for successful estrus synchronization and artificial insemination may be limiting factors.

MOTIVATORS AND BARRIERS FOR ADOPTION

To understand practices and technology adoption in agriculture, it is critical to recognize that financial indicators alone are not always good predictors (Kuehne et al. 2017). Research into adoption of agricultural practices and technologies conducted by Kuehne et al. (2017) grouped motivations and barriers into four main overarching groups:

(1) the relative advantage of the population (such as preference for profitability and/or risk aversion);
(2) learning characteristics of the innovation;
(3) the learnability of the population; and
(4) relative advantage of the innovation.

Findings indicate that successful adoption of a practice in a specific population depends on their values and motivations, financial capacity, and social networks. For a practice to be viable, characteristics such as improved profitability, environmental benefits, or risk reduction are seen as desirable and will likely lead to adoption.

Makinde et al. (2022) found the main barriers to technology adoption among feedlots were:

(1) costs, return on investment;
(2) technology usability;
(3) lack of awareness of technologies and their capabilities; and
(4) perceived relevance of the technology.

Smaller beef cattle operations with less access to resources and capital would be less likely to adopt practices that require expensive initial purchases (Lazurko et al., 2024). Smaller operators are more likely to work off-farm, so **time** required to research, test, and implement practices is also limited.

Many practices are correlated with **herd size**, including feed and soil testing, use of drones, and technologies such as *autosteer*. For a good number of these practices, time and cost are frequently cited as reasons for not adopting. On larger operations, small improvements in economic returns can often cover the upfront costs.

With respect to influencing adoption decisions, Lazurko et al. (2024) reported almost half (49%) of producers consider **veterinarian advice** when making ranch operational decisions. Further, an estimated 41% of producers consider **input from their peer groups** in operational decisions, and 56% consider peer group opinions with respect to marketing decisions. Advice from accountants is considered by 64% of producers with respect to farm financial decisions. A smaller number of producers consider advice from paid consultants (13%) and extension personnel (12%) when making decisions. From the AALL survey (AALL, 2024), the main sources of information for producers were producer organizations (68%); personal experience (63%); veterinarians (59%); service providers, such as feed companies and nutritionists (59%); and other producers (57%). Print and online magazines remain the dominant form of information access (73%), followed by trade shows (54%).

Adoption of practices and technologies are correlated with operators' level of **education**. Producers with post-secondary education (i.e., college diploma or university degree) were found to implement practices such as feed testing, nutritionists, cover crops, planned crop rotations, no-till, buffer zones, soil testing, and organic amendment more often compared to producers with a lower education level (Shah et al., 2022; Lazurko et al., 2024).

Improvements on one technology or practice can also impact willingness to adopt another. For example, advances in *radio frequency identification* (RFID) tag reading technology may encourage an increase in

adoption of digital herd management records, given the ease and convenience of collecting individual animal data.

PRODUCER VALUES

To understand operational motivators, the *Department for Environment, Food and Rural Affairs* (DEFRA) in the United Kingdom devised a segmentation model that identified five distinct categories of producer based on values. The categories are summarized by AALL (2023):

- ***Custodians*** are committed to conservation and protecting the countryside and are strongly motivated by farming heritage.
- ***Lifestyle Choice*** producers derive most income from non-farming activities and are more motivated by lifestyle factors than financial gain.
- ***Pragmatists*** seek to balance lifestyle with profitability, open to new ideas but still value tradition.
- ***Modern Family Business*** producers aim to maximize efficiency and create viable businesses that can be handed down to future generations.
- ***Challenged Enterprises*** describe producers that struggle financially and are anxious about the survival of their business.

This model allows participants to choose one of the five categories that they feel is most appropriate for their farm. Using these DEFRA categorizations, a 2023 survey, conducted on behalf of the AALL, found that more than half of the 115 Alberta-based producer respondents categorized their operations as custodian and modern family business (AALL, 2023). The results from 170 beef producers in the *Canadian Cow-Calf Cost of Production Network* showed a similar, but more pronounced, trend (CRS, 2023). See Table 8 for a comparison of producer values from the two surveys.

TABLE 8. CATEGORIES OF PRODUCER, PROPORTION BY DEFRA TYPE

Type of Operator	AALL, 2023	CDN COP Network (2021-23)
Custodians	32.6%	55.0%
Lifestyle Choice	12.1%	8.0%
Pragmatists	17.8%	6.0%
Modern Family Business	22.8%	29.0%
Challenged Enterprises	14.7%	3.0%

Source: AALL, 2023 and CRS, 2023.

Many producers who completed this survey (ranging from 33% to 55%) appreciate history and conservation as custodians. However, a significant portion (35% to 41%) also fall into the pragmatist and modern business categories, indicating that profitability remains an important operational goal for others.

Evidence shows that producers' values vary. Therefore, practices need to appeal to a diverse range of operational goals or positively impact one goal without negatively affecting others. Many practices examined in this report have substantial trade-offs that could limit adoption.

ENVIRONMENTAL MANAGEMENT

Producers who identify as **custodians,** exhibiting a strong commitment to conservation and protecting the countryside are more likely to be motivated by non-financial factors when it comes to practices related to environmental management. Knowledge mobilization is key in raising custodians' awareness of practices with environmental impacts.

Producers who reported having an *Environmental Farm Plan* (EFP) were aware of agriculture's effects on the environment and were learning about ways to reduce its negative impacts (Government of British Columbia, 2024). Their ultimate goal is to balance the industry's economic and environmental sustainability.

TABLE 9. CANADIAN FARMS AND BEEF FARMS WITH A COMPLETED OR IN-PROGRESS ENVIRONMENTAL FARM PLAN (EFP)

	Region	Canada	NL	PE	NS	NB	QC	ON	MB	SK	AB	BC
All Farms	**Completed EFP (%)**	37	--	68	59	63	76	42	27	23	25	28
	In-progress EFP (%)	8	--	--	5	--	7	7	8	9	8	10
Beef Farms	**Completed EFP (%)**	29	--	--	--	--	--	42	26	24	28	26
	In-progress EFP (%)	9	--	--	--	--	--	5	11	10	9	11

Source: Statistics Canada, 2023.

At a national level, there was a slight increase in the proportion of farms with a completed EFP in 2021 (37%) versus 2011 (35%). The largest increases are in British Columbia (28% vs. 21%), Ontario (42% vs. 38%), and Québec (76% vs. 72%) (Table 9).

GOVERNMENT PROGRAMS

Certain practices have historically been encouraged and supported by government programs. The latest Government of Canada initiatives through the *On-Farm Climate Action Fund* (OFCAF, AAFC, 2025b) and *Living Labs* (AAFC, 2025a) aim to support Canadian producers who want to adopt management practices that store carbon and reduce greenhouse gases. Specific areas of investment are ***nitrogen management, cover cropping, and rotational grazing*** practices. During the first intake period of the OFCAF program, a total of 13 projects commenced nationwide, accounting for up to $189 million in support (AAFC, 2025b). Despite these efforts, Carlberg (2024) notes that overall government program funding has declined and needs to be increased to previous levels to continue advancing the sustainability and productivity of the Canadian agriculture industry.

COMMUNICATING WITH PRODUCERS

Effectively communicating with beef producers requires understanding their concerns, motivations, and preferred information sources. By addressing barriers, leveraging key drivers of adoption, and emphasizing both financial and non-financial motivators, extension services and industry stakeholders can enhance the uptake and maintenance of beneficial tools and practices, leading to more sustainable and profitable beef production systems.

Barriers to Adoption

There are several common barriers that hinder producers from adopting practices, including:

- ***Lack of Awareness and Information.*** Many producers may not be familiar with the current information on practices due to limited access to educational resources (Lubell et al., 2011). Uncertainty about whether new approaches will work in specific conditions, climate, or soil types creates hesitation.
- ***Support and Training Deficits.*** Inadequate technical support, training programs, or extension services can hinder adoption. Most farmers need ongoing support to successfully implement new practices, but such resources are limited or inaccessible in some areas.
- ***Skepticism and Resistance to Change*****.** Some producers may be wary of new methods, especially if they contradict traditional practices that have been deemed successful for generations (Lubell et al., 2011).
- ***Perceived Complexity and Risk.*** If a practice is seen as too complicated or risky without clear benefits, adoption is less likely (Pannell et al., 2006).
- ***Time and Labour Constraints.*** Many operations are already stretched thin, which makes it challenging to implement new processes that might initially decrease productivity during their establishment phase, before the benefits are realized (Dearing & Cox, 2018).
- ***Scale and Operation Size Challenges.*** Some innovations are designed for large-scale operations and may not be economically viable for smaller farms and ranches. Conversely, some practices that work well for smaller operations may not scale effectively.
- ***Financial Limitations.*** Cost often represents the most significant barrier. Upfront costs can be a larger barrier for younger operations or those with smaller herds, having fewer animals to spread overhead costs across and longer time to payoff. Limited access to affordable credit or financing options compounds this challenge.
- ***Social and Cultural Factors.*** Peer influence, industry norms, and cultural traditions can impact decision-making (Pannell et al., 2006).

Drivers of Adoption

To promote adoption, communication strategies should leverage key drivers, such as:

- ***Perceived Benefits.*** Demonstrating tangible improvements in productivity, animal health, or environmental sustainability can encourage uptake (Pannell et al., 2006). When producers can see that an innovation will increase profits, reduce costs, or improve efficiency, adoption becomes much more likely. Government subsidies, tax incentives, or cost-share programs can also tip the economic balance in favor of adoption.
- ***Trust in Information Sources.*** Producers are more likely to adopt recommendations from credible, respected sources, such as veterinarians, university extension services, or fellow producers (Arbuckle et al., 2015).
- ***Demonstration of Success.*** Field trials, case studies, and peer testimonials help validate the effectiveness of recommended practices (Pannell et al., 2006).

- ***Ease of Implementation.*** Simplifying practices and offering step-by-step guidance increases the likelihood of adoption (Pannell et al., 2006). User-friendly technologies, practices that integrate well with existing operations, and innovations that don't require extensive training or infrastructure changes are more readily adopted. Compatibility with current systems and gradual implementation or trial options also encourage uptake.
- ***Regulatory Compliance.*** If a practice aligns with industry regulations or future policy changes, producers may be more willing to implement it (Dearing & Cox, 2018).

Non-Financial Motivators

While financial incentives can play a key role, several non-financial factors significantly impact adoption decisions:

- ***Stewardship and Sustainability.*** Many producers take pride in responsible land and animal management, making environmental and ethical considerations strong motivators (Lubell et al., 2011).
- ***Peer Influence and Community Support.*** Producers often trust insights from other farmers who have successfully implemented changes (Arbuckle et al., 2015).
- ***Reputation and Market Access.*** Enhancing farm reputation and gaining access to premium markets through certification programs may motivate adoption of practices required for certification. Innovations that help farmers and ranchers produce higher quality products, achieve better results, or demonstrate superior management skills can be highly motivating, as is being recognized by peers as a leader.
- ***Intrinsic Satisfaction.*** Producers who see improvements in animal health and productivity often gain a sense of accomplishment and job satisfaction (Pannell et al., 2006) leading to maintaining adoption of related practices.
- ***Quality of Life Improvements.*** Practices that improve work-life balance with opportunity for time away from the operation, reduce stress, reduce time demands during critical periods, or make tasks more enjoyable can be significant motivators.
- ***Generational Considerations.*** If they are the decision maker, younger producers may be more open to adopting new technologies and innovative practices, particularly if they see long-term benefits for the sustainability of their family operation.
- ***Independence and Autonomy.*** Many farmers value independence and self-reliance, which can influence adoption decisions. Practices that increase dependence on external suppliers or services may be resisted. The desire to maintain operational independence can outweigh economic considerations.

Effective communication with beef producers is essential to encourage the adoption of practices that improve productivity, animal welfare, and environmental sustainability. Understanding the barriers, drivers of adoption, and non-financial motivators can enhance the success of extension programs and outreach efforts (Rogers, 2003; Pannell et al., 2006).

HOW TO READ THIS REPORT

Adoption rates from the 2019 Adoption Rates report (BCRC, 2019a) are compared to the 2022-23 CCCS (CCCS, 2024), along with additional literature. This report uses data from 2013 to 2024 for adoption rates on each category of interest. Tables compare previous estimates side-by-side with updated adoption rates. Note that the year of data collection is not the same as the publishing year (see distinction Table 2 and Table 3).

An increase or decrease could be both positive or negative, depending on the context. The following symbols are used to describe the observed trends (Table 10).

TABLE 10. TREND INTERPRETATION

↑	The trend is increasing, a desirable outcome (e.g. unassisted calving)	↓	The trend is decreasing, a desirable outcome (e.g. calving season length)
↑	The trend is increasing, an undesirable outcome (e.g. death loss)	↓	The trend is decreasing, an undesirable outcome (e.g. parasite control)
↔	The trend is stable	?	The trend is uncertain due to insufficient data

Insights for Knowledge Mobilization. This is a thought-provoking section designed to encourage knowledge mobilization practitioners to act upon the information provided. It is not comprehensive, nor exhaustive.

Perceived Status: This section provides the authors' general sense of the practices' adoption or performance level based on current and historical values, regional suitability, and appeal to different management systems. Nuance is required when applying the results, as status may vary by region. Further research is needed to validate the status of each practice and provide specificity based on province or target audience segment. Perceived status was categorized as follows:

- ***Close to peak adoption or performance – support with regular communications and knowledge mobilization.*** Performance levels, practices or technologies that have gained widespread traction among producers, but as new producers enter the sector continual reinforcement is required.
- ***Decreased adoption or performance – driven by weather, markets or information.*** These practices or technologies have gained widespread traction among producers; but decreases were observed, which may be due to environmental or economic forces, new information or alternatives becoming available.
- ***Improving, but low adoption or performance - increase depth of adoption.*** There is evidence of widespread awareness of the practice or technology among Canadian cow-calf producers, but they are not applying it to the full potential, or performance levels are below standards. Physical and financial barriers may prevent broader adoption or improvements. Helping producers to address these barriers with creative solutions is required.
- ***Low adoption or performance - could be targeted with knowledge mobilization materials.*** There is evidence that the practices or technologies are not well understood or appreciated by producers. Developing or disseminating effective knowledge mobilization resources is needed to improve performance levels or enhance awareness and adoption of innovation.

- ***Emerging or under-served topics.*** Practices or technologies where research results do not yet provide clear recommendations to producers. Effective knowledge mobilization is needed to inform producers about new information and knowledge gaps that research can address.
- ***Niche practices.*** Practices or technologies that are only suitable for specific operations and herds. It is recommended that knowledge mobilization resources be available for producers to learn about these practices, and adoption be monitored.

Barriers: This section identifies producer perceived barriers from survey results.

Resources: While not a comprehensive list of available tools, the resources listed in this section serve as a starting point for those wanting to learn more.

Opportunities: This section provides the authors' general sense of potential opportunities for the practice based on the literature cited. Readers are encouraged to draw their own conclusions, based on personal experience and their local context.

ADOPTION RATES OF RECOMMENDED PRACTICES

REPRODUCTIVE MANAGEMENT

The main goal of a cow-calf operation is for each cow to produce a calf every year. Reproductive management is fundamental to the profitability of cow-calf operations. The adoption of beneficial management practices and technologies specific to reproduction varies across regions and between different types of beef farm.

Potential practices and standard targets for reproductive management practices include:

- ***Open rates.*** Target is less than 6% for cows and 8% for heifers (BCRC, 2024i).
- ***Calving season.*** Limit breeding seasons to 60–80 days for better herd management and uniform calf crops (Chenoweth & Sanderson, 2005; Colazo & Kastelic, 2012; Sanguinetti et al., 2025).
- ***Calving distribution.*** The target is for 60% or more of cows to calve within the first 21 days of the calving season, or 80% within the first 42 days. (Funston et al., 2012a).
- ***Body Condition Scoring (BCS).*** Maintain cows at 3.0-3.5 BSC to optimize fertility and manage winter feeding (Kunkle et al., 2021; Waldner, et al., 2022).
- ***Pregnancy checking.*** Identify open cows early and cull non-productive animals to improve herd efficiency. Alternatively, feed cows until prices rally in the spring if winter feeding practices are conducive to weight gain (CRS, 2017c).
- ***Replacement heifer management.*** Cows should be exposed to breeding for 63 days or less, and heifers should be bred at least 14 days earlier than cows, given their longer postpartum interval (80-100 days for heifers versus 50-60 days for cows). Ensure replacement heifers reach 55% to 65% of mature weight depending on management system, breed and operation goals before breeding to maximize fertility and longevity (Funston et al., 2012b; Lardner et al., 2013; Kasimanickam et al., 2021).
- ***Bull fertility testing.*** Conduct breeding soundness exams as close to breeding as possible each season to ensure bulls are capable of impregnating cows.
- ***Artificial Insemination (AI) and Estrus Synchronization.*** Reproductive technologies offer the potential to accelerate genetic improvement and reduce the calving window.

OPEN RATES

Open Rate measures the proportion of open or unbred cows and heifers at pregnancy testing (i.e., unbred females divided by females exposed). The target for open rates is less than 6% for cows and 8% for heifers (BCRC, 2024i). This target was not previously met in any region, and currently, only Eastern Canada is estimated to meet this benchmark (Table 11). The cow herd open rate in Ontario dropped from 10.9% in the 2017 survey to 6.9% in the 2022-23 CCCS (CCCS, 2024). This improvement results in a lower cow herd open rate for Ontario producers compared to those in Western Canada, though not as low as producers in Québec and the Maritimes, who have a cow herd open rate of 4.1%. Western Canadian producers outside Saskatchewan have maintained an open rate for cows of slightly above 7%; however, given the dry conditions experienced in the region in the 2020s, maintaining this open rate may be interpreted as an indicator of resiliency.

National open rates in heifers (11.0%) remain higher than in cows (7.4%) in the 2022-23 CCCS (Table 11) (CCCS, 2024). Because heifers are still growing to their mature weight (target 55-65%) at the time of first pregnancy and continue to grow throughout the breeding season and gestation, their open rates are often inherently higher (Funston et al., 2012b; Lardner et al., 2013; Kasimanickam et al., 2021). Additionally,

there is a slightly greater focus on pregnancy checking heifers compared to cows, which allows for earlier culling if they are found open.

TABLE 11. AVERAGE COW OPEN RATE

Region	2019 Adoption Rates Report (BCRC, 2019a)	2022-23 Canadian Cow-Calf Survey (CCCS, 2024)	Trend
Canada	-	Cows 7.4%, heifers 11.0%	?
QC & MT	-	Cows 4.1%, heifers 8.1%	?
ON	Cows 10.9% [a]	Cows 6.9%, heifers 8.6%	↓
MB	Cows 8%, heifers 12% [b]	Cows 10.1%, heifers 13.2%	↑
SK		Cows 7.0%, heifers 11.2%	↓
AB		Cows 7.8%, heifers 11.0%	↔
BC		Cows 7.1%, heifers 11.0%	↓

Sources: [a] 2017 OCCS (University of Guelph, 2018); [b] 2016-17 WCCCS II (University of Saskatchewan, 2018)

Insights for Knowledge Mobilization

Perceived Status: Close to peak adoption. Recommend supporting existing adoption with regular communications.

Western Canada exhibits a stable open rate trend for cows, slightly decreasing from 8% in the 2016-17 WCCS (University of Saskatchewan, 2018) to 7.6% in the 2022-23 CCCS (CCCS, 2024). Similarly for heifers, the open rate experienced a marginal improvement moving from 12% in the 2016-17 WCCCS (University of Saskatchewan, 2018) to 11.6% in the 2022-23 CCCS (CCCS, 2024). These open rates, however, are still above the 6% and 8% targets for cows and heifers, respectively.

Eastern Canada has experienced a decreasing positive trend with cow open rate falling from 10.9% as reported in the 2017 OCCS (University of Guelph, 2018) to 5.6%, reported in the 2022-23 CCCS (CCCS, 2024). Heifer open rate was calculated at 8.1%, as reported in the 2022-23 CCCS (CCCS, 2024). These open rates align with the 6% cow and 8% heifer open rate targets.

Barriers: High cattle prices might lead producers to prioritize keeping open cows for another year over developing a heifer, thereby forgoing the opportunity cost of selling the heifer.

Resources: The *Cow-Calf Production Indicator Tool* (BCRC, n.d.-d) allows producers to enter their own data (only 15 data points needed) to be compared against provincial averages from the 2022-23 CCCS (2024). Metrics include the GOLD[3] metrics, with calving distribution, and weaning rates.

Opportunities: Recognize that if cow-calf producers have high or low costs and/or productivity, it will influence their culling strategy for open cows. This impacts the management strategies and incentive to address high open rates. A culling strategy decision-making tool would increase producer awareness of how their operation aligns with current practices, but it may not change adoption of reproductive practices. Effective communication on the impacts of proper cattle nutrition and trace mineral supplementation is an opportunity to improve pregnancy status within a herd (For more details, see the Mineral Supplementation section) (Van Emon et al., 2020; Harvey et al., 2021). Methods with the potential of lowering open rates include ensuring heifers are selected from proven dams, an effective heifer and

[3] In the late 1980's, Alberta Agriculture and Rural Development established a set of production metrics that followed the acronym GOLD for Growth, Open Rate, Length of Calving, and Death Loss.

second calver management protocol, culling unproductive cows, and ensuring cattle meet their nutrient requirements.

CALVING SEASON AND DISTRIBUTION

Breeding season and calving season length are inherently connected. Producers control the timing and duration of bull exposure to define their breeding season, this way they influence when and for how long their cows and heifers will calve. According to the 2022-23 CCCS (CCCS, 2024), the national **breeding season length** averages 96 days for cows and 90 days for heifers. This means that cows experienced longer breeding cycles to allow additional chances for breeding (on average, just under four and a half 21-day breeding cycles). Eastern Canada producers have traditionally allowed for a longer breeding season compared to Western Canada. Producers should target a calving season length of 60-80 days, with 63 days being ideal, for a uniform calf crop and to provide adequate post-partum recovery time. Calving season has been consistently shorter than breeding season, indicating that producers use other strategies to shorten the calving season.

While calving season length has progressively shortened in Canada over the past decade (Table 12), only producers in Alberta have consistently managed an average calving season length of under 80 days. Producers in Saskatchewan and British Columbia have been very close to the benchmark (approximately 82 and 88 days, respectively); however, producers in Manitoba have been well above target at 100 days on average. Producers in Ontario have made substantial progress reducing the length of the calving season from an average of 119 days to 99 days. Producers in the Maritimes remain well above the benchmark at 118 days, which is only a few days shorter than the previous average of 121 days.

TABLE 12. AVERAGE CALVING SEASON LENGTH

<table>
<tr><th>Region</th><th>2019 Adoption Rates Report (BCRC, 2019a)</th><th>2022-23 Canadian Cow-Calf Survey (CCCS, 2024) [d]</th><th>Trend</th></tr>
<tr><td>Canada</td><td>-</td><td>89 days</td><td>?</td></tr>
<tr><td>MT</td><td>121 days [a]</td><td rowspan="2">118 days</td><td>↔</td></tr>
<tr><td>QC</td><td>-</td><td>?</td></tr>
<tr><td>ON</td><td>119 days [b]</td><td>99 days</td><td>↓</td></tr>
<tr><td>MB</td><td rowspan="4">86.5 days [c]</td><td>100 days</td><td>↑</td></tr>
<tr><td>SK</td><td>82 days</td><td>↓</td></tr>
<tr><td>AB</td><td>78 days</td><td>↓</td></tr>
<tr><td>BC</td><td>88 days</td><td>↔</td></tr>
</table>

Sources: [a]2017 ACCS (Maritime Beef Council, 2018); [b]2017 OCCS (University of Guelph, 2018); [c]2016-17 WCCCS II (University of Saskatchewan, 2018); [d]2022-23 CCCS (CCCS, 2024).

Only 32.3% of respondents have adopted a breeding window of 63 days or less for cows (CCCS, 2024). Similarly, within the C3SN (Waldner et al., 2024), a breeding season of fewer than 63 days for cows was practiced by 32% of respondents in Western Canada, and only by 12% of the producers in Eastern Canada (Waldner et al., 2024). Similarly, on a per province basis in the 2022-23 CCCS results reported this practice was most common in Alberta (43.6% of cows) and Saskatchewan (34.9% of cows) herds and the least common in Ontario (20% of cows), and Québec and the Maritimes (15.5% of cows) (CCCS, 2024). Within both surveys, there was higher adoption of a 63-day or less breeding season for heifers (CCCS, 2024; Waldner et al., 2024).

Calving distribution influences calf crop uniformity and consistency, aiding in calf health and marketability (BCRC 2024b; Funston et al., 2012a). A narrower calving distribution also impacts labour and time. The target is to have 60% or more of cows calving in the first 21 days of the calving season, or 80% within the first 42 days. At a national level, the 2023 calving distribution for cows averaged 58% within the first 21 days, 26.2% in the next 22 to 42 days, 10.3% in the next 43 to 63 days, and 4.8% after 63 days (CCCS, 2024).

TABLE 13. BREEDING AND CALVING LENGTH AND DISTRIBUTION FOR COWS ACROSS REGIONS

Region	Breeding Season Length 63 Days		Trend	Calving Season Length (days)	% of Cows Calved in the First 21 Days		Trend
	Past	Current [c]		Current	Past	Current [c]	
Canada	-	32.3%	?	96	-	58.0%	?
QC & MT	-	15.5%	?	131	-	46.2%	?
ON	-	20.0%	?	114	54.0% [a]	54.0%	↔
MB	20% [b]	27.3%	↑	104	55.0% [b]	53.6%	↔
SK		34.9%	↑	87		60.7%	↑
AB		43.6%	↑	80		63.4%	↑
BC		27.4%	↑	95		54.4%	↔

Sources: [a] 2017 OCCS (University of Guelph, 2018); [b] 2016-17 WCCCS II (University of Saskatchewan, 2018); [c] 2022-23 CCCS (CCCS, 2024).

Insights for Knowledge Mobilization

Perceived Status:

Western Canada: Close to peak adoption. Recommend supporting existing adoption with regular communications.

Within Western Canada, there is an increasing positive trend in calving distribution, with calving in the first 21 days trending from 55.0% as reported in the WCCCS II (University of Saskatchewan, 2018) to 60.4% as reported in the 2022-23 CCCS (2024), on target with the 60% industry goal. Similarly, the breeding season under or at 63 days trended from 20% in the WCCCS II (University of Saskatchewan, 2018) to 42.4% for heifers and 37.2% for cows in the CCCS (2024).

Eastern Canda: Below target. Recommend targeting with knowledge mobilization materials.

For Eastern Canada, there is a decreasing negative trend for calving distribution, with calving in first 21 days trending from 54.0% in the 2017 OCCS (University of Guelph, 2018) to 52.0% in the 2022-23CCCS (2024). This is below the 60% industry target. The breeding season under or at 63 days in the region is at 26.5% for heifers and 18.2% for cows (CCCS, 2024).

Barriers: Shortening breeding and calving seasons to avoid high open rates and maintain herd size takes time. This often requires several years of incrementally reducing the breeding season length, until the desired length is achieved. The CCCS (2024) reported Eastern Canada having a lower percentage of producers using a shortened breeding season.

Breeding season length can be negatively affected by using community pastures where producers lack full control over when or how easily they can remove bulls from the herd. In addition, producers' interest in this practice may vary throughout the cattle cycle. For example, periods of high calf prices encourage longer calving seasons, while higher production cost periods encourage the adoption of greater efficiencies.

Resources: The *Cow-Calf Production Indicator Tool* (BCRC, n.d.-d) allows producers to enter their own data (only 15 data points are needed) to compare against provincial averages from the 2022-23 CCCS .

The *Value of Calving Distribution Calculator* (BCRC, n.d.-k) allows producers to compare their numbers to the provincial benchmark and national target to see the potential value from making management changes. BCRC also has the *Calving Seasons* (BCRC, 2025d) topic page.

Opportunities: Shortening the breeding season presents an opportunity to reduce the labour associated with calving and creates a more uniform calf crop based on weight and age at weaning. Calving distribution was one of the most common requests for future farm scenarios in the Canadian Cow-Calf Cost of Production Network.

National open rates averaged 7.4% for cows and were the highest in Manitoba (10.1%) and lowest in Québec and the Maritimes (4.1%). Québec and the Maritimes also reported the longest breeding season length (131 days), contributing to a lower open rate and more cycles for cows to get bred (CCCS, 2024). However, this practice may have been implemented to lead to more diversity in their calf crop age and weaning weights.

BODY CONDITION SCORING

Cows with an ideal body condition score (BCS) of 3-3.5 have higher pregnancy rates, and are less likely to abort (Kunkle et al., 2021). There are some correlations between cow BCS and calf health as well. For example, a higher incidence of calf diarrhea has been associated with producers who do not use BCS (Waldner et al., 2022).

The proportion of producers that regularly body condition score using the visual method (68-82.5%) has increased in every province since the 2019 report, particularly in the Maritimes and Ontario. The 2022-23 CCCS (2024) found that visual BCS increased from 2017 in both Western and Eastern Canada, while the hands-on approach (5.3-20.7%) remained somewhat stagnant (Table 14) (BCRC 2024b). The hands-on approach has been shown to be more effective in evaluating BCS, as factors such as long hair and body shapes, especially in the winter, could obscure the visual assessment of BCS (Government of Saskatchewan, n.d.).

The hands-on approach is less common in the Prairies. Hands-on scoring is a considerable time commitment and requires handling equipment, whereas visual assessment does not. Technologies that assess BCS using 3D imaging are also becoming available (Ruchay, et al., 2020).

The proportion of producers who are using BCS to manage cows is also increasing. Approximately 80% of producers in the Western provinces are using BCS to manage cows, while in Eastern Canada this proportion is lower at 60-70% (Table 14).

TABLE 14. PROPORTION OF RESPONDENTS THAT REGULARLY BODY CONDITION SCORE

Region	2019 Adoption Rates Report (BCRC, 2019a)	2022-23 Canadian Cow-Calf Survey (CCCS, 2024)	Trend
Canada	-	13.7% hands-on, 74.0% visual	?
MT	17% (hands-on or visual) [a]	20.7% hands-on, 70.7% visual	↑
QC	50% (hands-on or visual) [b]		↑
ON	23% (hands-on or visual) [b]	13.2% hands-on, 67.0% visual	↑
	26% (hands-on or visual) [c]		↑
MB	13% (hands-on), 64% (visual) [d]	5.3% hands-on, 82.5% visual	↑
SK		9.3% hands-on, 80.6% visual	↑
AB		15.6% hands-on, 73.0% visual	↑
BC		18.5% hands-on, 68.5% visual	↑

Sources: [a] 2017 ACCS (Maritime Beef Council, 2018); [b] Northern Ontario and Northern Quebec Cow-Calf Production (Lamothe and North Haven Solutions, 2018); [c] 2017 OCCS (University of Guelph, 2018); [d] 2016-17 WCCCS II (University of Saskatchewan, 2018).
[b] Cows only.

TABLE 15. PROPORTION OF PRODUCERS THAT MANAGE COWS ACCORDING TO BODY CONDITION SCORE

Region	2019 Adoption Rates Report (BCRC, 2019a	2022-23 Canadian Cow-Calf Survey (CCCS, 2024)	Trend
Canada	-	74%	?
MT	33% [a]	60%	↑
QC	-		?
ON	-	70%	?
MB	56-73% [b,c]	79%	↑
SK		75%	↑
AB		79%	↑
BC		84%	↑

Sources: [a] 2017 ACCS (Maritime Beef Council, 2018); [b] 2013-14 WCCCS (Western Beef Development Centre, 2015); [c] 2016-17 WCCCS II (University of Saskatchewan, 2018).

Insights for Knowledge Mobilization

Perceived Status: Improving, but low adoption. The recommended strategy is to increase adoption.

Within Western Canada, the use of the hands-on method for BCS has exhibited a stable trend, moving from 13% as reported in the WCCCS II (University of Saskatchewan, 2018) to 12.6% as reported in the 2022-23 CCCS (2024). The visual method has increased from 64% in the WCCCS II to 74.5% in the 2022-23 CCCS (2024).

In Eastern Canada, the BCS trend is unknown. The reported use of both the hands-on and visual methods were 17% in the 2017 ACCS (Maritime Beef Council, 2018); 23% in Ontario and 50% in Québec, as reported

by Lamothe and North Haven Solutions (2018); 26% in the 2017 OCCS (University of Guelph, 2018); and 15.5% for the hand-on and 65.8% for the visual method as reported in the 2022-23 CCCS (2024).

Barriers: The main reasons for not implementing BCS, as reported in the 2022-23 CCCS (2024), were that cattle appear fine (15.3%), not knowing how to use the hands-on method (6.5%), and lack of confidence in managing based on body condition scores (5.9%). Time constraints were cited as a barrier by 3.3% of producers, while a lack of facilities and/or labour was cited by 4.7% (CCCS, 2024). Producers who manage much larger herds may not have time to use the hands-on approach for every animal and producers managing few animals and who have off-farm jobs may be constrained by time.

Based on these responses, it appears that knowledge gaps on how to score and manage the herd based on body condition scores remain. On the other hand, labour and cost barriers seem to be relatively minor, meaning that adoption could peak soon if the remaining knowledge gaps are closed.

Resources: BCRC *Body Condition* (BCRC, 2023e) topic page and *Feed Cost Calculator*. Government of Sasktchewan's (n.d.) *BSC Guide*. *The Code or Practice for the Care and Handling of Beef Cattle* (National Farm Animal Care Council, 2013) includes a BCS overview in *Appendix A*, including a description of how to use the hands-on method for determining BCS.

Opportunities: Continue to communicate how to use the hands-on method for BCS. Due to the relatively low cost associated with BCS, the opportunity for producers may lie more on reducing time constraints than on further reducing costs.

PREGNANCY CHECKING

Pregnancy checking allows producers to make culling and marketing decisions based on the reproductive status of females. If pregnancy checking is performed in the fall, the open females can be sold prior to winter feeding or fed for the white fat market in the spring when prices are higher. This strategy is beneficial for producers who have winter feeding systems readily available and when the value from additional pounds gained exceeds the cost of that gain (CRS, 2017c).

Results of the CCCS (2024) across Canada suggest 63.5% of respondents pregnancy checked cows, and 67.8% pregnancy checked heifers (Table 16). Alberta and Manitoba reported the highest pregnancy checking rates for cows at 70%, while British Columbia reported the lowest at 50%. For heifer pregnancy checking rates, Saskatchewan reported the highest adoption levels at 76%, and Ontario the lowest at 55%. British Columbia, Ontario, and Québec exhibited the highest responses indicating infrequent or no pregnancy checking.

According to the C3SN, 85% of respondents within Western Canada pregnancy tested all females, and 11% pregnancy tested only some. Within Eastern Canada, 78% of respondents reported pregnancy testing all females, and 19% pregnancy tested only some (Waldner et al., 2024). Both surveys show that Eastern Canada and British Columbia had lower rates of pregnancy checking compared to the Prairie Provinces.

TABLE 16. PREGNANCY CHECKING FEMALES (ALWAYS OR ALMOST ALWAYS)

Region	Pregnancy Checking Heifers		Pregnancy Checking Cows		Trend
	Past	Current [d]	Past	Current [d]	
Canada	-	67.8%	-	63.5%	?
QC & MT	47% [a]	58.6%	47% [a]	55.2%	↑
ON	64% [b]	54.9%	66% [b]	50.5%	↓
MB	71% [c]	73.7%	62% [c]	70.2%	↑
SK		76%		68.2%	↑
AB		72.5%		70.1%	↑
BC		55.6%		50%	↓

Sources : [a] 2017 ACCS (Maritime Beef Council, 2018); [b] 2017 OCCS (University of Guelph, 2018); [c] 2016-17 WCCCS II (University of Saskatchewan, 2018); [d] 2022-23 CCCS (CCCS, 2024).

Lamothe and North Haven Solutions (2018) reported that 75% of producers in Northern Ontario used ultrasound for pregnancy checking. In contrast, Greaves' (2019) thesis reported 63.9% of Ontario producers conducted pregnancy checks on cows and from those producers, 72.4% did rectal palpation, followed by ultrasound at 21.8%. Ultrasound can help detect early pregnancy, fetal age, and identify the sex of the fetus (BCRC, 2023b). Depending on local availability and costs, producers could benefit from this additional information to determine fetus age for calving management planning, especially when breeding lengths are longer.

Insights for Knowledge Mobilization

Perceived Status: Close to peak adoption. Recommended strategy is to maintain current adoption rates with regular communications.

Both Western and Eastern Canada exhibit a stable trend in pregnancy checking rates. Within Western Canada, pregnancy checking rates for heifers have trended from 71% as reported in WCCCS II (University of Saskatchewan, 2018) to 70.4% as reported in the 2022-23 CCCS (2024). For cows, pregnancy checking rates range from 62% as reported in WCCCS II (University of Saskatchewan, 2018) to 66.0% as reported in the 2022-23 CCCS (2024).

Within Eastern Canada, pregnancy checking rates for heifers have trended from 47% as reported in the 2017 ACCS (Maritime Beef Council, 2018), 64% as reported in the 2017 OCCS (University of Guelph, 2018), to 50.3% as reported in the 2022-23 CCCS (2024). For cows, pregnancy checking rates range from 47% as reported in the 2017 ACCS (Maritime Beef Council, 2018), 66% as reported in the 2017 OCCS (University of Guelph, 2018), to 54.2% as reported in the 2022-23 CCCS (2024).

Barriers: Common reasons for not pregnancy checking reported by the 2022-23 CCSS (CCCS, 2024) include producers able to identify if females were open (e.g., cattle showing signs of heat after the breeding season); selling open females after calving, when the cull price is higher (26.2%); and high costs or financial gain not being high enough (13.3%). The top two reasons from the WCCCS II (University of Saskatchewan, 2018) are selling females after calving when prices are higher (31%) and able to identify if females were open (30%); these reasons are consistent with the with the results in the 2022-23 CCCS (2024).

Resources: BCRC *Pregnancy Detection* (BCRC, 2025b) topic page (BCRC, 2023a). The *Economics of Preg-Testing Calculator* (BCRC, n.d.-i) allows producers to evaluate the pros and cons of three management

options: 1) pregnancy checking and culling open females; 2) feeding cows until spring peak; and 3) not pregnancy-checking and winter all cows, and culling open cows after calving. Different production systems mean that producers will choose the option that works best for their operation.

Opportunities: Open females represent a significant opportunity cost. Younger open females are either given a grace year and kept in the herd or they are culled after only producing one calf. By pregnancy checking and assessing the amount of feed available, producers can better understand the cost of maintaining open females through the winter versus culling them in the fall.

When prices are rising, the benefits of holding open cows to the spring is large. However, when the price cycle turns the upside in prices is driven more by seasonality than tight supplies, potentially reducing the benefit. Producers who are driven by financial factors may change their practices with the cattle cycle.

REPLACEMENT HEIFER MANAGEMENT

Heifers require specialized management to ensure they breed early, calve successfully, and rebreed within an acceptable time frame to help guarantee a calf each year. Past and current Canadian survey results indicate that heifers typically have a shorter breeding and calving season, are more likely to be pregnancy-checked, and start calving earlier than cows.

Research recommends exposing cows to breeding for 63 days or less, and for heifers to be bred at least 14 days earlier than cows given their longer time to return to fertile estrus (80-100 days for heifers versus 50-60 days for cows). Just over a quarter of national respondents bred heifers before cows, giving their younger females a head start for the following calving season (CCCS, 2024). The C3SN (Waldner et al., 2024) reported 12% of respondents bred heifers two weeks before cows in Western Canada and 10% in Eastern Canada. In addition, 40% of heifers in Western Canada and 15% of heifers in Eastern Canada had a breeding season shorter than 63 days, a shorter duration than the breeding season reported for cows during in the same survey. This indicates a focus on ensuring heifers calve within the desired breeding and calving period early in their production years.

The reported national average calving season length was 59 days for heifers in the 2022-23 CCCS (CCCS, 2024). Alberta had the shortest calving season length (53 days for heifers), while Québec and the Maritimes had the longest calving season (74 days for heifers). Nationally, 63.8% of heifers calved in the first 21 days, 24.6% in the next 22 to 42 days, 7.4% in the next 43 to 63 days, and 4% calved after 63 days (CCCS, 2024).

Nationally, 67.8% of respondents pregnancy checked heifers (CCCS, 2024,Table 16). Again, the focus is on keeping heifers on track with the main cow herd, with all provinces having higher pregnancy checking rates for heifers than for cows.

Overall, producers were more likely to adopt shorter breeding and calving season lengths for heifers relative to the main cow herd, helping to ensure heifers were within the desired breeding and calving windows to set the stage for future success. Replacement heifers were often more closely managed to ensure that the ones who remained in the herd were productive and met the herd's requirements. Replacement heifers being bred before cows allowed rebreeding opportunities if one cycle was missed.

TABLE 17. BREEDING SEASON AND CALVING SEASON FOR HEIFERS ACROSS REGIONS

Region	Breeding Heifers prior to Cows	Breeding Season Length 63 Days	Calving Season Length (days)		Trend
	Current	Current [d]	Past	Current [d]	
Canada	26.5%	38.4%	-	59	?
QC & MT	20.8%	33.3%	49 [a]	74	↑
ON	24.7%	21.8%	81 [b]	59	↓
MB	13.5%	27%	57 [c]	70	↑
SK	32%	44.8%		58	↔
AB	27%	50%		53	↓
BC	31.8%	22.2%		58	↔

Sources : [a] 2017 ACCS (Maritime Beef Council, 2018); [b] 2017 OCCS (University of Guelph, 2018); [c] 2016-17 WCCCS II (University of Saskatchewan, 2018); [d] 2022-23 CCCS (CCCS, 2024).

Insights for Knowledge Mobilization

Perceived Status: Improving, but low adoption. The recommended strategy is to increase depth of adoption.

Western and Eastern Canada have observed a stable trend in replacement heifer management practices. In Western Canada, the heifer breeding season is typically 63 days or less, with 42.4% of heifers bred within this period and 27.3% of heifers bred before cows. (BCRC, 2024b). The heifers' average calving days have remained steady at 57 days when compared to the WCCCS II (University of Saskatchewan, 2018) and the 2022-23 CCCS (CCCS, 2024).

Within Eastern Canada, the 2022-23 CCCS reported 26.5% of the heifer breeding season is typically 63 days or less, and 20.4% of heifers are bred before cows (CCCS, 2024). Heifers calving days have trended from 49 days as reported in the 2017 ACCS (Maritime Beef Council, 2018), 81 days reported in the 2017 OCCS, (University of Guelph, 2018) to 65 days reported in the 2022-23 CCCS (CCCS, 2024).

Barriers: Small herds managed together represent a limitation for giving heifers an earlier breeding season.

Resources: BCRC has the *Heifer Development* (BCRC, 2023a) and *Breeding Cow Management* (BCRC, 2024i) topic pages.

Opportunities: Manitoba had the lowest adoption of breeding heifers prior to cows (13.5%; CCCS, 2024). This presents an opportunity to encourage producers to breed heifers earlier to ensure their calving cycle is aligned with the main herd, reduce unnecessary culling, prioritizing replacement female longevity and productivity in the herd or having a non-uniform calf crop.

In addition to breeding earlier, ensuring replacement heifers reach 55-65% of mature weight before breeding helps to maximize fertility and longevity (Funston et al., 2012b; Lardner et al., 2013; Kasimanickam et al., 2021). While weight is a crucial factor, other factors like age, body condition score, nutrition status, and genetic potential also play a role in heifer development and reproductive success.

BREEDING SOUNDNESS EXAMS AND REPRODUCTIVE DISEASES

Bull infertility and reproductive diseases can lead to reproductive failure and be very costly to cow-calf operators. Having a veterinarian test bulls for fertility, disease, and examining their overall breeding soundness can prevent problems and expenses. Testing bulls annually, just prior to the start of the breeding season, is recommended because results can change from year to year and even season to season, even if a bull was tested at the time of purchase. This annual testing is especially important when purchasing bulls that have already completed a breeding cycle.

Nationally, the 2022-23 CCCS found 59.5% of respondents always or almost always completed a breeding soundness evaluation for their breeding bulls (CCCS, 2024). The lowest adoption of breeding soundness evaluations was found in Eastern Canada and British Columbia. For reproductive disease testing, the Prairie Provinces have the highest adoption rates (Table 18).

TABLE 18. BULL BREEDING SOUNDNESS EXAMS AND REPRODUCTIVE DISEASES (ALWAYS OR ALMOST ALWAYS)

Region	Breeding Soundness Exam		Trichomoniasis Disease Testing		Vibriosis Disease Testing		Trend
	Past	Current [d]	Past	Current [d]	Past	Current [d]	
Canada	-	59.5%	-	24.7%	-	21.3%	?
QC & MT	7% [a]	27.6%	-	13.8%	-	13.8%	↑[e]
ON	17% [b]	20.9%	1% [b]	5.5%	-	4.4%	↑ [f]
MB	72% [c]	71.9%	25% [c]	28.1%	22% [c]	24.6%	↑
SK		74.4%		35.7%		27.9%	↑
AB		79.1%		30.3%		27%	↑
BC		33.3%		16.7%		16.7%	↓

Sources: [a] 2017 ACCS (Maritime Beef Council, 2018); [b] 2017 OCCS (University of Guelph, 2018); [c] 2016-17 WCCCS II (University of Saskatchewan, 2018); [d] 2022-23 CCCS (CCCS, 2024).
[e] Only for soundness exam trend; [f] Vibriosis testing trend unknown.

Insights for Knowledge Mobilization

Perceived Status: Western Canada is close to peak adoption. Recommend supporting existing adoption with regular communications.

Within Western Canada, there is a steady trend from the WCCCS II survey (University of Saskatchewan, 2018) to the 2022-23 CCCS (CCCS, 2024) in bull testing. Specifically, bull soundness exam testing trended from 72% to 71.4%, Trichomoniasis bull testing from 25% to 29.9%, and Vibriosis bull testing from 22% to 25.7%.

Eastern Canada is improving, but adoption is still low. The recommended strategy is to increase depth of adoption.

Within Eastern Canada, there is an increasing positive trend with bull soundness exams trending from 7% as reported in the 2017 ACCS (Maritime Beef Council, 2018), 17% as reported in the 2017 OCCS (University of Guelph, 2018) to 23.5% reported in the 2022-23 CCCS (CCCS, 2024). Trichomoniasis bull testing was reported at 1% in the 2017 OCCS (University of Guelph, 2018), increasing to 8.7% in the 2022-23 CCCS (CCCS, 2024). Vibriosis bull testing is currently at 8.1% in Eastern Canada as reported in the 2022-23 CCCS (CCCS, 2024).

Barriers: The top reasons for not testing bulls included producers being satisfied with their conception rate, thus seeing no need to test (34.2%) and the belief that bulls were adequately tested at the time of purchase (32.2%) (CCCS, 2024)[4]. Additional reasons included the use of artificial insemination (CCCS, 2024). Although not the primary breeding animals, cleanup bulls should still undergo testing. Additionally, operators may face limitations such as insufficient infrastructure or a lack of safe handling facilities for bull testing.

Resources: BCRC has the *Bull Management* (BCRC, 2025a) topic page. It is recommended that, for future extension efforts, comprehensive topic pages be divided into more digestible segments for broader dissemination among producers via various mediums.

Opportunities: British Columbia and Eastern Canada are two regions where increased adoption of bull testing would be beneficial, however adoption of breeding soundness evaluations is rising in the latter. Ontario survey respondents previously indicated that they considered a breeding soundness evaluation less important than other bull selection criteria (University of Guelph, 2018).

BREEDING TECHNOLOGIES

Breeding technologies such as *artificial insemination* (AI) and *embryo transfer* (ET) enable producers to access superior genetics and use proven bulls [high accuracy *Expected Progeny Differences* (EPDs) based on many progeny]. However, these technologies require specialized equipment and facilities, expertise, estrous synchronization, the use of both semen and clean-up bulls, and additional labour and management.

Breeding technology requires either an investment in technical skills through an AI course or hired labour for AI or ET. For semen straw storage, a nitrogen tank's upkeep and cost must be considered. In addition, there are risks of varying conception rates due to, but not limited to, semen and embryo quality, as well as the protocol and skills of the inseminator. Seedstock producers are often more willing to adopt and bear the costs and risks of breeding technology to improve bull genetics, as they have repeat customers willing to pay a premium for improved genetics. Genomic technologies have the potential for rapid genetic improvement. However, it is important to consider whether the specific operational, environmental, and management conditions of a commercial operation will allow to fully utilize high-powered genetics. Implementing breeding technologies on specific groups, such as heifers, could reduce the total number of heifer bulls or the total of limited-service bulls on site (note that clean-up bulls will still be necessary). This approach also reduces the risk of injury and improves the longevity of heifers. Nevertheless, these benefits and costs need to be assessed by an individual operation.

Limited differences in adoption were seen between commercial and purebred herds in the 2022-23 CCCS, with one being that among those who used AI, adoption was generally higher for heifers than for cows (CCCS, 2024, Figure 5).

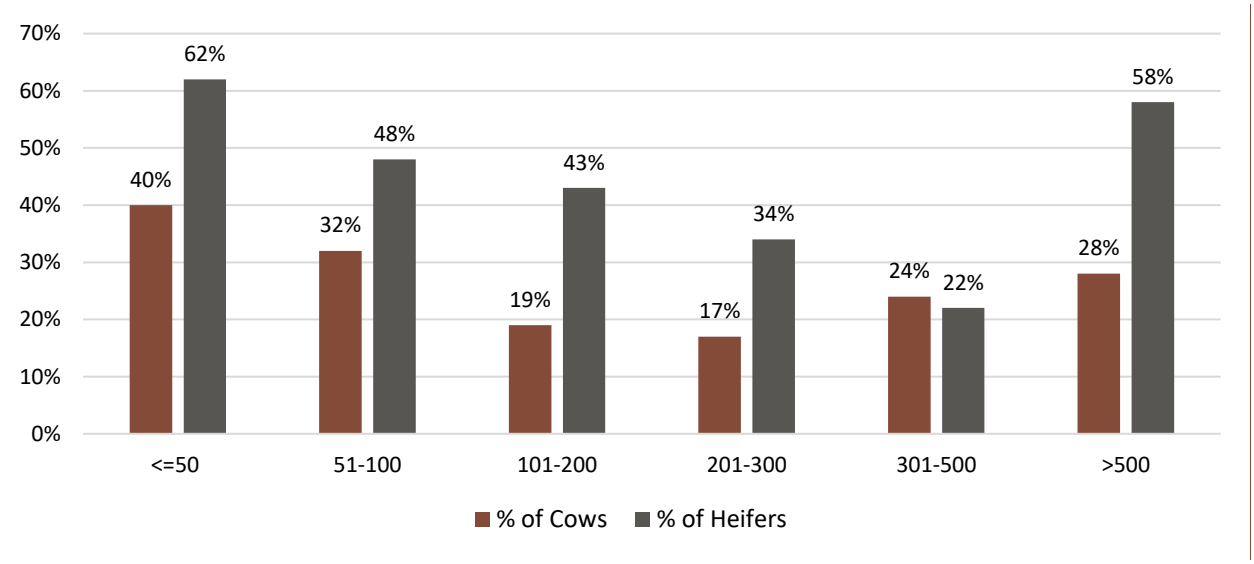
[4] Respondents chose from a set of pre-determined options.

TABLE 19. BREEDING AT LEAST ONE FEMALE WITH AI AND ET BREEDING TECHNOLOGIES

Region	Artificial Insemination (AI)		Trend	Embryo Transfer (ET)		Trend
	Past	Current [d]		Past	Current [d]	
Canada	-	28.5%	?	-	5.8%	?
QC & MT	53% [a]	51.7%	↓	12% [a]	5.2%	↓
ON	41% [b]	48.4%	↑	15% [b]	7.7%	↓
MB	18% [c]	28.1%	↑	5% [c]	1.8%	↓
SK		17.8%	↓		6.2%	↑
AB		23.2%	↑		6.6%	↑
BC		16.7%	↓		3.7%	↓

Source: [a] 2017 ACCS (Maritime Beef Council, 2018); [b] 2017 OCCS (University of Guelph, 2018); [c] 2016-17 WCCCS II (University of Saskatchewan, 2018); [d]2022-23 CCCS (CCCS, 2024).

FIGURE 5. ADOPTION OF AI FOR COMMERCIAL COWS VERSUS HEIFERS, BY HERD SIZE



* Average are Based on AI percentage of each cow-calf respondent who practices AI.
Source: 2022-23 CCCS (CCCS, 2024).

Insights for Knowledge Mobilization

Perceived Status: Niche Practice. Recommend that knowledge mobilization resources be available for producers to learn about these practices, and for adoption be monitored. But recognize that the practice is only suitable and of interest to a subset of producers.

Within Western Canada, there is an increasing positive trend with the use of AI trending from 18% in the 2016-17 WCCCS II (University of Saskatchewan, 2018) to 21.5% in the 2022-23 CCCS (CCCS, 2024), and with the use of ET reported at 5% in the WCCCS II (University of Saskatchewan, 2018) to 5.5% in the CCCS (CCCS, 2024).

Within Eastern Canada, there is a stable to decreasing negative trend, with AI trending from 41% in the 2017 OCCS (University of Guelph, 2018), 53% in the 2017 ACCS (Maritime Beef Council, 2018) to 49.7% in the 2022-23 CCCS (CCCS, 2024), and with the use of ET reported at 12% in the 2017 ACCS (Maritime Beef Council, 2018), 15% in the 2017 OCCS (University of Guelph, 2018) to 6.7% in the 2022-23 CCCS (CCCS, 2024).

Barriers: There is greater adoption for heifers than cows. This may reflect the additional labour required to sort cows from calves for processing versus heifers which require no sorting.

Resources: BCRC Artificial Insemination topic page. BCRC *Bull Valuation Calculator*. Kasus State University (KSU) *Bull versus AI Breeding Costs Calculator*. Texas A&M *Conventional AI Heifer Budget*.

Opportunities: Clear communication regarding the expectations and risks associated with these technologies is essential, ensuring producers understand expected conception rates and the continued need for 'clean-up' bulls.

CALF HEALTH AND MANAGEMENT

Knowing how and when to intervene with calves is critical for reducing calf mortality, improving growth rates, and enhancing long-term profitability.

Potential practices and standard targets for calf health and management practices include:

- ***Unassisted Calving.*** Select heifers and bulls with optimal calving ease genetics and maintain appropriate body condition scores to reduce birthing difficulties. Intervene in calving only if there is no progress after 60 minutes for heifers or 30 minutes for cows, following proper calving assistance protocols. Assist difficult births promptly and monitor first-calf heifers closely to reduce calf mortality.
- ***Calf Death loss.*** Reported as the number of calf deaths divided by the number of live calf births; initial target is less than 5%.
- ***Calf Resuscitation.*** The calf recovery position is recommended for resuscitating newborn calves.
- ***Early life interventions***. Ensure calves consume 10% of their body weight in high-quality colostrum within the first 6 hours to optimize passive immunity. Monitor for early signs of diarrhea and respiratory distress, and intervene with supportive care. Provide clean, dry bedding and windbreaks to protect newborns from extreme weather conditions, reducing stress and hypothermia risks.
- ***Painful Procedures.*** Conduct dehorning and castration as young as feasible. If performed on older animals, provide pain mitigation.

UNASSISTED CALVING

The *Beef Code of Practice* requires that cows be monitored to identify calving difficulties and ensure prompt assistance when needed. Caesarean sections must be conducted by a veterinarian or qualified trained personnel using accepted surgical techniques, appropriate local anesthesia, and post-operative pain control. Calving assistance (dystocia) can negatively affect profitability. Lucio et al. (2024) found that beef cows with unassisted births had an expected profit $169.18 greater than cows with assisted births, and this difference was $151.32 greater for unassisted heifers.

Calving assistance rates have decreased since 2017 in Western Canada (Table 20). Waldner et al. (2024) found that the mean incidence of calving assistance was 8.9%, while severe dystocia occurred at an average rate of 3.7%. A similar trend was seen in Eastern Canada from 1999 to 2017 and from 2017 to 2024. The original benchmark rate for unassisted births from heifers in Québec was 78% and 94.2-95.2% for cows (Dutil et al., 1999). Again, these results are similar to the estimates from Waldner et al. (2024).

Improved management through adequate nutrition, sire selection, and/or incremental genetic improvements where the calf size is more ideally suited to the mother size could all contribute to these results.

TABLE 20. PROPORTION OF UNASSISTED CALF BIRTHS

Region	Cows		Heifers	
	Past	Current	Past	Current
East	-	92.6% [b]	-	75.6% [b]
West	79.0% [a]	95.5% [b]	63.0% [a]	83.8% [b]

Source: [a] 2016-17 WCCCS II (University of Saskatchewan, 2018); [b] 2018-22 C3SN (Waldner et al., 2024).

Insights for Knowledge Mobilization

Perceived Status: Close to peak adoption. Recommend supporting existing adoption with regular communications.

Within Western Canada, there is an increasing positive trend in unassisted calving, with the unassisted calving for cows trending from 79.0% in 2017 (University of Saskatchewan, 2018), to 95.5% in 2022-23 (Waldner et al., 2024). Heifers also experienced an increase in unassisted calving rates from 63.0% in 2017 (University of Saskatchewan, 2018) to 83.8% in 2022-23 (Waldner et al, 2024).

Currently, there is no trend available for Eastern Canada. The 2022-23 rate of unassisted calving for cows is 95.6% and 75.6% for heifers (Waldner et al., 2024).

Barriers: The ability to assist with calving may depend on time commitments (Moggy et al., 2017), which could reduce the capacity of smaller operations to do so. Both large farms with several cows calving in a short interval, and smaller farms where one or more of the owners may be working off-farm can present challenges to assist with calving needs. Prompt treatment during calving complications helps reduce calf morbidity and mortality while improving cow breeding in the future.

Focusing on calving ease may reduce dystocia but may involve a cost. Weaning weight as a percentage of mature cow weight is currently below target, as addressed in the *Growth* section in this report. Avoiding dystocia may be the trade-off in optimizing genetic potential.

Resources: BCRC *Calf 911 Calving and Reproduction* resources. Includes a video and quick reference guides.

The *Code of Practice for the Care and Handling of Beef Cattle* (National Farm Animal Care Council, 2013) has a comprehensive outline in Appendix C to help producers determine if and when to assist with calving. Producers may need to consult with their veterinarian on a case-by-case basis regarding calving difficulties.

Opportunities: The rate of dystocia within the herd is correlated with, but not limited to, selecting bulls for calving ease. There are opportunities for continued communication on how to prevent dystocia and how to assist with calving when required. Producers could benefit from extension material detailing the use of *non-steroidal anti-inflammatory* (NSAID) for cows after difficult calving, highlighting their positive impact on cow and calf welfare and performance (Lucio et al., 2024).

CALF MORTALITY

Calf death loss from cows has decreased and is now below 5% in most provinces. Only producers in Québec, the Maritimes, and British Columbia have calf death loss above 5% for cows. Producers in British Columbia experienced a marginal (0.2%) decrease in death loss between survey years, whereas calf death loss among Atlantic and Québec producers increased during the same period (Table 21). However, this

may be due to the inclusion of producers from the Atlantic Provinces' producers in the Maritimes and Québec calculation, rendering the actual trend unknown.

TABLE 21. AVERAGE CALF DEATH LOSS

Region	2019 Adoption Rates Report (BCRC, 2019a)	2022-23 Canadian Cow-Calf Survey (CCCS, 2024) [d]	Trend *
Canada	-	Cows 4.6%, heifers 6.4%	?
MT	-	Cows 6.4%, heifers 7.0%	?
QC	4-5% [a]		↑
ON	4-11% [a] (N. Ontario)	Cows 4.0%, heifers 7.4%	↔
	Cows 3.66%, heifers 1.07% [b]		
MB	5.4% [c]	Cows 4.7%, heifers 6.5%	↓
SK		Cows 4.5%, heifers 6.5%	↓
AB		Cows 4.4%, heifers 6.2%	↓
BC		Cows 5.2%, heifers 6.1%	↔

Sources: [a] Northern Ontario and Northern Quebec Cow-Calf Production (Lamothe and North Haven Solutions, 2018); [b] 2017 OCCS (University of Guelph, 2018); [c] 2016-17 WCCCS II (University of Saskatchewan, 2018); [d] 2022-23 CCCS (CCCS, 2024).
**Trend only for calf death loss from cows.*

Calf mortality is a major factor affecting operation profitability. Factors affecting the risk of mortality and causes of loss are typically different in calves who die during birth or the first 24 hours, than in calves that die between 24 hours of life and weaning (Waldner et al., 2024). Causes of death in the first 24 hours include dystocia, myocardial necrosis or myopathy, developmental abnormalities, and skeletal myopathy (Waldner et al., 2010). Calves that are lost later, die from trauma, septicemia, starvation, abomasal ulcers and perforations, enteritis or colitis, pneumonia, and other intestinal incidents. While it has been several years since a detailed postmortem study has been completed in Canadian beef herds, recent studies have collected data on calf mortality between birth and weaning.

Calf mortality has consistently been higher in Eastern Canada compared to the West (Table 22). Data from the C3SN between 2019 and 2022 shows that calf mortality was 2.4% within 24 hours of birth in Western Canada and 3.4% in Eastern Canada for all calves born from both cows and heifers. Furthermore in Western Canada, 3.6% of calves born to cows and heifers died from 24 hours after birth to weaning, compared to 4.9% in Eastern Canada (Waldner et al., 2024). These regional differences have remained consistent with previous reports (Lamothe and North Haven Solutions, 2018; University of Guelph, 2018; University of Saskatchewan, 2018).

The 2022-23 CCCS reported that 38% of all pre-weaning mortalities of calves born to cows and 43% of calves born to heifers in Western Canada occurred within 24 hours of birth (CCCS, 2024). Once calves survive beyond 24 hours, their chances of reaching weaning significantly increase.

Calf mortality within 24 hours of birth has slightly decreased in the Western Provinces for both cows and heifers but has increased in the East. Calf mortality between 24 hours after birth and weaning has increased nationally for heifer-born calves and in the west for cow-born calves. In contrast, this type of calf mortality has decreased in the east for cow-born calves.

TABLE 22. CALF MORTALITY BY COW OR HEIFER BIRTHS AND AGE AT DEATH

Region	Mortality rate within 24 hours of birth				Mortality rate from 24 hours of birth to weaning			
	Cows		Heifers		Cows		Heifers	
	Past	Current [c]	Past	Current [c]	Past	Current [c]	Past	Current [c]
East	3.0% [a]	3.3%	4.1% [a]	4.4%	5.3% [a]	4.7%	3.4% [a]	6.9%
West	2.7% [b]	2.1%	4.4% [b]	3.7%	2.5% [b]	3.4%	2.4% [b]	4.9%

Source: [a] 2017 OCCS (University of Guelph, 2018) ; [b] 2016-17 WCCCS II (University of Saskatchewan, 2018); [c] 2018-22 C3SN (Waldner et al., 2024).

Comparing causes of death is often challenging due to data groupings that may not be directly comparable. The 2019 Adoption Rates Report listed ***dystocia, scours*** (diarrhea), and ***pulmonary and respiratory diseases*** as common causes of calf mortality (Waldner et al., 2013). Scours were noted as being a very common cause of mortality in Eastern Canada because of confined housing use during the winter. Historically, as reported in the 2017 OCCS, approximately 31-52% of all calf deaths were due to scours (University of Guelph, 2018). The proportion of deaths attributed to scours appears to have decreased since then, to an estimated 24.5% as reported in the 2022-23 CCCS, (CCCS, 2024). Respiratory disease has increased as a cause of death in the east, which previously had been on par with western herds.

Scours and respiratory related causes of death for western herds are estimated to have stayed stable. This suggests that if the western herd calf mortality is indeed increasing, both of these causes are increasing by about the same proportion. The WCCCS II (University of Saskatchewan, 2018) and Tang & Lhermie (2023) studies found that 11.6% of calf deaths in Western Canada were from **scours/diarrhea, while** 16.5% were from ***respiratory disease*** (Table 23).

TABLE 23. PROPORTION OF CALF DEATHS ATTRIBUTED TO SCOURS/DIARRHEA OR RESPIRATORY DISEASE

Region	Scours/Diarrhea		Respiratory disease	
	Past	Current [c]	Past	Current [c]
East	31% heifers, 52% cows [a]	24.5%	9% heifers, 15% cows [a]	22.4%
West	11.6% [b]	11.1%	16.5% [b]	15.8%

Source: [a] 2017 OCCS (University of Guelph, 2018), [b] Tang & Lhermie, 2023; [c] 2022-23 CCCS (CCCS, 2024)
[a] Causes of death for calves after 24 h after birth.

Herds that started calving before April were more likely to have calves die before 30 days of life compared to those that started calving later. However, this trend did not persist between 30 days and weaning. Herds that started to calve earlier were also more likely to report treating more calves for *bovine respiratory disease* **(BRD)**, *diarrhea*, and *navel* or *joint infections*, as well as calf deaths from respiratory disease. Calves from herds in the east were more likely to be treated or die from **diarrhea** compared to calves from western herds (Waldner et al., 2024).

Insights for Knowledge Mobilization

Perceived Status: Improving, but low adoption. The recommended strategy is to increase depth of adoption.

Western Canada has exhibited a decreasing positive trend in calf mortality, with calf death loss within the first 24 hours of life from cows trending from 3.1% in the 2016-17 WCCCS II (University of Saskatchewan,

2018) to 2.2% in the 2022-23 CCCS (CCCS, 2024). Calf death loss after 24 hours of life from cows was stable at 2.2% in the WCCCS II (University of Saskatchewan, 2018) and 2.4% in the CCCS (CCCS, 2024). Calf death loss from scours has remained stable at 11.6% from the 2016-17 WCCCS II (University of Saskatchewan, 2018) and 11.1% in the 2022-23 CCCS (CCCS, 2024). Finally, calf death loss from respiratory disease went from 16.5% in the WCCCS II (University of Saskatchewan, 2018) to 15.8% in the CCCS (CCCS, 2024).

Within Eastern Canada, there is a stable trend for calf mortality, changing less than 1%. With calf death loss within the first 24 hours of life from cows going from 1.6% in the 2017 OCCS (University of Guelph, 2018) to 2.4% in the 2022-23 CCCS (CCCS, 2024b), and calf death loss after 24 hours of life from cows going from 2.1% in 2017 (University of Guelph, 2018) to 2.8% in 2022-23 (CCCS, 2024). Calf death loss from scours is at 22.4% and calf death loss from respiratory disease is at 24.5% (CCCS, 2024).

Barriers: While a lower calf mortality rate is better for profitability, there are diminishing returns to effort as calf mortality decreases.

Resources: BCRC *Calf 911 Calving and Reproduction* resources. It includes videos, graphics, and quick reference guides.

Opportunities: Communicating information about multiple practices that reduce the risk of scours/diarrhea and respiratory disease in calves would allow producers to select practices suited to their operation. Several resources have been developed by the University of Calgary, which also communicate the multiple benefits of a single practice. For example, Tang & Lhermie (2023), found that cow-calf producers who had a breeding season interval of 63 days or less resulted in a lower calf mortality percentage than those who had a longer breeding season.

Supplementing cows with selenium during pregnancy was associated with a lower risk of scours in their calves (Guyot et al., 2007). Calving heifers ahead of cows reduced the risk of scours in the herd (Waldner et al., 2022). Vaccinating cows and heifers against *E. coli* reduced the risk of scours and scours-related deaths in calves (Myers et al., 1981; Cornaglia et al., 1992). Sorting cow-calf pairs into nursery pastures resulted in a lower risk of scours in calves 1 to 5 days of age and lowered their risk of respiratory diseases (Walder et al., 2022). Additionally, calf diarrhea and navel infections were less common in large pasture calving or when utilizing the sandhills calving method (Waldner et al., 2024).

Introducing new cattle to the herd was associated with a higher risk of respiratory disease in calves (Hanzlicek et al., 2013; Woolums et al., 2013; Waldner et al., 2022). Calving cows and heifers together and overwintering and calving them in the same pasture were associated with a higher risk of respiratory disease in calves (Waldner et al., 2022).

CALF RESUSCITATION

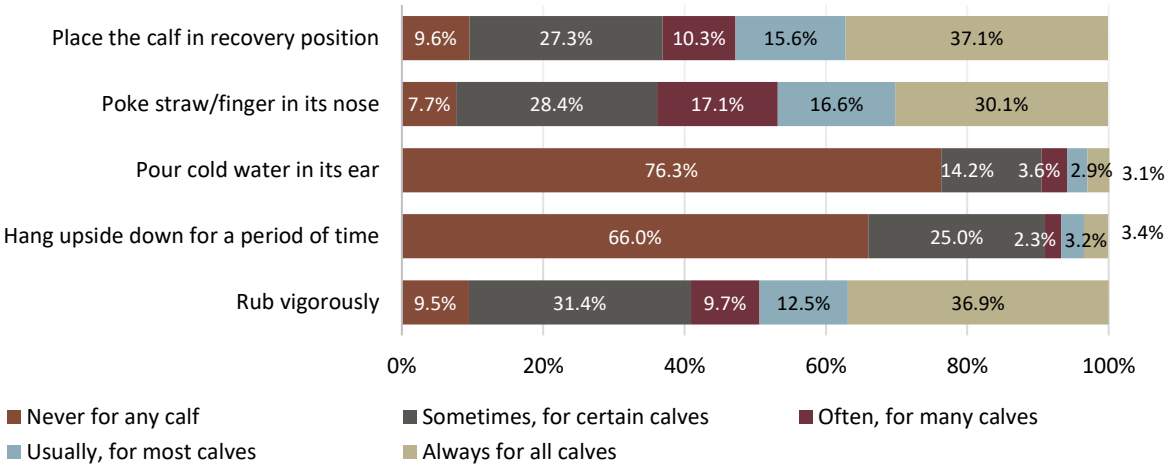
A calf's first day of life represents its highest risk period for mortality and morbidities, which can subsequently have long-term impacts on performance. The calf recovery position is the first recommended step for resuscitating newborn calves. This is done by placing the calf up on its sternum, pulling the front feet forward to allow the chest to expand, and pulling the back legs up toward the calf's ears. Rub the calf vigorously, stimulate breathing by poking the nasal septum with a piece of straw or squirt a few drops of cold water in the ear to cause them to gasp. Hanging calves upside down to drain fluid is not recommended, as this only empties the stomach and puts undue pressure on the diaphragm.

Canadian producers employ varied approaches to resuscitate unresponsive newborn calves. Placing the calf in the recovery position and rubbing vigorously are veterinary recommended practices, with 37% of respondents always using this technique. Followed by poking straw or a finger in the nose, with 30% of

respondents always using this technique. Hanging calves upside down or pouring cold water in the ear were rarely utilized, with 66 to 76% of respondents, respectively, never employing these methods.

Additionally, respondents noted using *other* methods such as respiratory and oxygen support (i.e., cardiopulmonary resuscitation by blowing air into the mouth or nose); temperature control (i.e., bringing the calf to a warm area or using a hot box with an insulated blanket); medical and nutritional supports (i.e., administering epinephrine or vitamin A/D/E or, applying molasses to the gums); and other techniques (e.g., Madigan Squeeze, using cold water on the face or body).

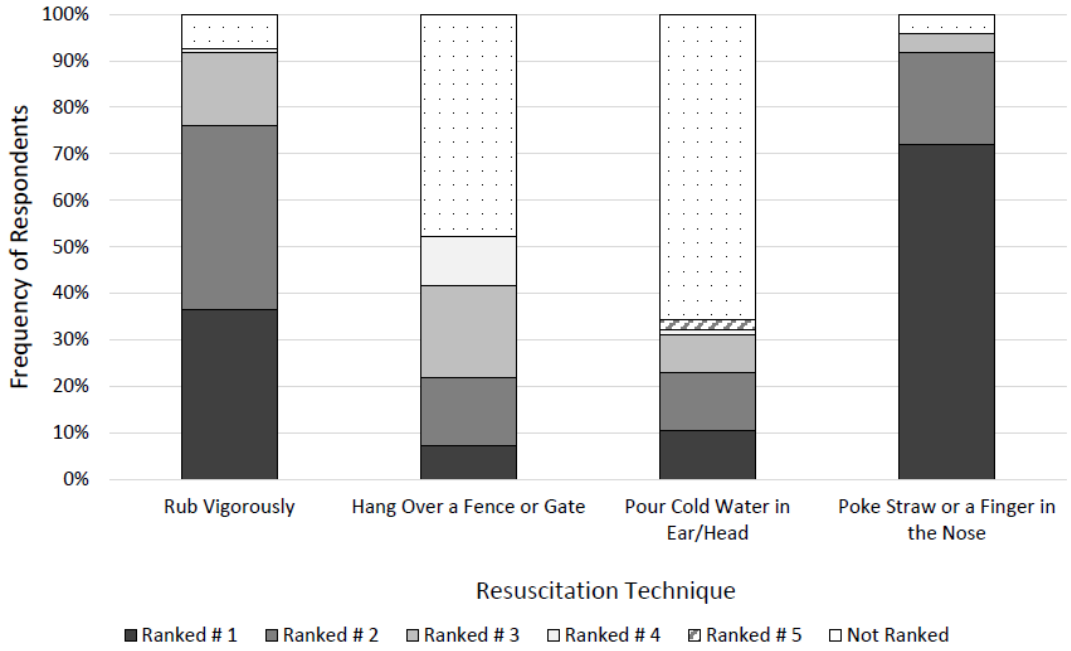
FIGURE 6. METHOD AND FREQUENCY OF RESUSCITATION PRACTICES, CANADA



Source: 2022-23 CCCS (CCCS, 2024).

Historically, calf resuscitation practices in Western Canada, such as rubbing vigorously, had an adoption rate above 90%. Similarly, poking the nose with a straw or finger was adopted by approximately 95% of producers (Pearson, 2019). Both practices are at a stable adoption rate. While Pearson (2019) reported that over 50% of producers hung calves over fences, more recent data (CCCS, 2024) shows this practice has decreased significantly, with only 35.2% of respondents employing it. This change illustrates a positive trend of disadoption of this harmful practice. Pouring cold water into an unresponsive calf's ear has remained a frequently used practice, with approximately 30% of respondents in 2016-17 (Pearson, 2019, Figure 7) adopting it, and a lower proportion of producers (22.7%) reporting utilizing the practice in 2022-23 (CCCS, 2024).

FIGURE 7. HISTORICAL RESUSCITATION PRACTICES IN WESTERN CANADA



Source: Pearson et al., 2019

Insights for Knowledge Mobilization

Perceived Status: New benchmark with 2022-23 CCCS (CCCS, 2024).

Recommended calf resuscitation practices. Close to peak adoption. Recommend supporting existing adoption with regular communications.

Within Western Canada, there is a stable trend of adoption for recommended practices for calf resuscitation, including rubbing vigorously and poking the nose with a straw or a finger. In Eastern Canada, the trend is unknown.

Harmful calf resuscitation practices. Decreasing, but adoption is still high. The recommended strategy is to decrease depth of adoption.

In Eastern Canada, the trend is unknown. In Western Canada, there is a decreasing positive trend in the adoption of hanging calves as a resuscitation practice.

Barriers: Lack of producer awareness of proper resuscitation practices for newborn calves. Producers want to do the right thing, but unlearning old information and habits requires time and continuous reinforcement.

Resources: BCRC *Calf 911 Calving and Reproduction* resources. Includes video and quick reference guides.

Opportunities: Continue communicating with producers before the calving season to remind them of the most successful resuscitation practices for calf survival.

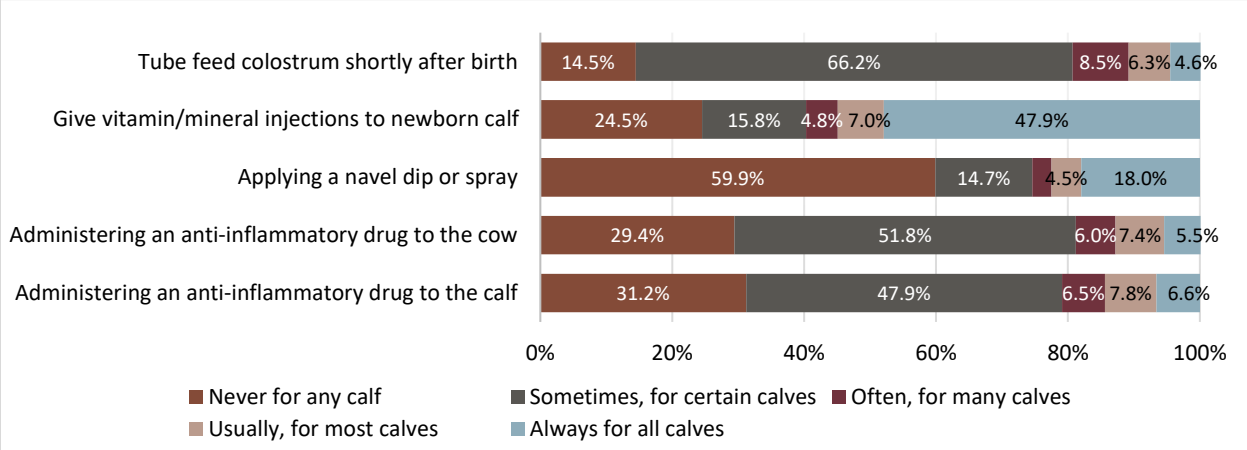
EARLY LIFE INTERVENTIONS

The *Beef Code of Practice* (National Farm Animal Care Council, 2013) requires that newborn calves be monitored to ensure they suckle their dams, paying special attention to high-risk cases. Producers are to administer fresh, frozen, or commercial colostrum substitute to any newborn calf showing signs of not receiving it from their dam. Sanguinetti et al. (2024) found that veterinary experts agree that feeding colostrum to calves who fail to nurse is a practice that is "always useful for all herds". In addition, operations that gave colostrum to all calves who needed calving assistance had lower calf mortality (Murray et al., 2016). Herds that checked if calves have sucked colostrum by checking udder fullness also had lower calf mortality (Murray et al., 2016).

The CCCS (CCCS, 2024) found that ***tube feeding colostrum*** shortly after birth was sometimes done by 66% of respondents. A high proportion of western producers (93.7%) verified that calves had received colostrum shortly after birth (Pearson et al., 2019). Determining that the cow udder did not look full (83.3% of respondents) or observing whether the calf looked full (44.2%) were the most common methods for ensuring colostrum intake (Pearson et al., 2019). To facilitate colostrum intake for calves who required calving assistance, 43.5% of producers restrained the cow to help the calf nurse, 41.1% placed cow and calf together in a pen, 24.2% tube fed the calf, and 18.9% bottle fed the calf. The method of colostrum delivery has been shown not to have a significant impact on the rate of calf mortality (Sanguinetti et al., 2025). Most producers used colostrum from the calf's dam (68.7%) or a colostrum replacement product (38.5%, Pearson et al., 2019).

Research has found that herds managed by producers that did not give ***Vitamin E and Selenium*** to calves at birth experienced a 10 times higher mortality than herds with producers who did (Waldner and Rosengren, 2009; Waldner et al., 2016). Vitamin and mineral deficiencies should also be assessed prior to administration. The 2022-23 CCCS found that vitamin and mineral injections for newborn calves were administered by 47.9% of respondents (CCCS, 2024).

FIGURE 8. CALVING INTERVENTION PRACTICES



Source: 2022-23 CCCS (CCCS, 2024).

Applying a ***navel dip or spray*** to calves was a less common practice, with 59.9% of respondents never adopting it, and only 18% consistently using it (CCCS, 2024). Navel dipping or spraying is more common in situations with calving in a barn, as it is a more crowded or contaminated space.

Calf health and survival are key priorities for cow-calf producers. Calves assisted at birth are often compromised and experience acidemia (i.e., respiratory acidosis), hypoxia, and soft tissue damage. A compromised calf may be delayed in consuming colostrum, increasing its risk of inadequate passive immunity transfer. This raises its odds of preweaning morbidity, mortality, and reduced growth (Pearson et al., 2019). This issue has raised questions about the value of pain mitigation during and after difficult calving, for both the cow and calf. Lucio (2023) found that calves that received meloxicam displayed more playful behavior and were more active during the first 24 hours after birth than calves that received a placebo. No other differences between treated and untreated cattle were observed.

The administration of ***anti-inflammatory drugs*** to newborn calves and their dams after assisted calving was done occasionally, with most respondents doing so sometimes (47.9% for calves, 51.8% for cows, as reported in the 2022-23 CCCS (CCCS, 2024). *Other* practices mentioned include providing oxytocin to cows, bottle-feeding colostrum, giving oral vitamins, administering nasal vaccines, and monitoring calves to ensure they are nursing and latching within two hours (CCCS, 2024).

Insights for Knowledge Mobilization

Perceived Status: Improving, but low adoption. Suggested strategy is to increase depth of adoption.

The historical trend across Canada is unknown. Within Western Canada, the current adoption of vitamin and mineral injections administered to calves is 28.8% and tube feed colostrum shortly after assisted calving is 12.0% (CCCS, 2024). Within Eastern Canda, the adoption of vitamin and mineral injections administered to calves is 11.6% and tube feed colostrum shortly after assisted calving it 22.1% (CCCS, 2024).

Barriers: Extensively managed herds would have minimal early life interventions, with spring processing primarily involving vaccination (see Vaccination section for more details). Producers managing these herds rarely maintain individual animal records but still would benefit from resources related to colostrum.

Resources: The BCRC *Calf 911 Calving and Reproduction* (BCRC, n.d.-g) resources include a video and *Colostrum Management* quick reference guide; *Calving and Calf Management* (BCRC, 2024j) topic page.

Opportunity: Continue to focus communications on the importance of receiving adequate amounts of colostrum and its multiple benefits.

Waldner (2014) and Pearson et al. (2019) have reported a greater likelihood of early life interventions being used by producers managing early calving herds. Targeting early calving herds with communications could support adoption, as these herds are typically managed more intensively and likely calve within barns. This is most likely because calving in freezing temperatures presents a higher risk of death and exposure.

PAINFUL PROCEDURES

Dehorning, branding, and castrating calves have historically been considered routine calf management procedures in Canada. These are all painful procedures. The *Beef Code of Practice* has addressed the value of pain management during such procedures, providing recommendations and requirements for producers (National Farm Animal Care Council, 2013). In addition, horns and brands can cause reductions in beef carcass and processing quality.

Attitudes towards pain management are shifting for Western Canadian cattle producers (Bassi et al., 2019). While traditional methods of castration and dehorning are still deeply rooted in the beef cattle

industry, producers are more aware of the pain associated by these procedures and what pain mitigation options are available.

DEHORNING

The portion of herds with more than 75% of calves polled in the 2022-23 CCCS was 80.6% nationally, steady to slightly lower than the 2019 adoption rates report (BCRC, 2019a; CCCS, 2024). This suggest that polled genetics may have reached peak adoption (BCRC, 2024b). By using polled cattle, cattle and humans are less likely to be injured, and painful procedures can be avoided altogether (Bassi et al., 2019).

TABLE 24. PROPORTION OF HERDS WITH MOSTLY POLLED ANIMALS (>75% OF CALVES)

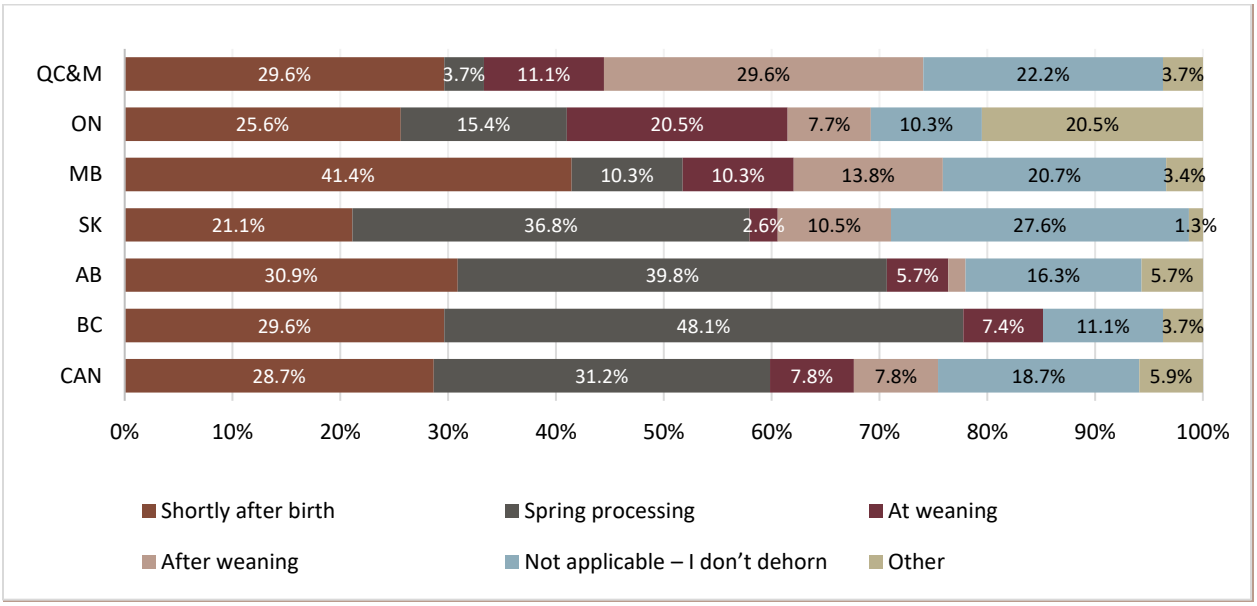
Region	2019 Adoption Rates Report (BCRC, 2019a)	2022-23 Canadian Cow-Calf Survey (CCCS, 2024) [d]	Trend
Canada	-	80.6%	?
MT	-	86.2%	?
QC	85% [b]		↔
ON	86% [a] ; 94% [b]	83.5%	↔
MB	89.3% [c]	85.7%	↔
SK		85.2%	↔
AB		73.9%	↓
BC		79.6%	↓

Sources : [a] 2017 OCCS (University of Guelph, 2018); [b] Northern Ontario and Northern Quebec Cow-Calf Production (Lamothe and North Haven Solutions, 2018); [c] 2016-17 WCCCS II (University of Saskatchewan, 2018); [d] 2022-23 CCCS (CCCS, 2024).

The *Beef Code of Practice* (National Farm Animal Care Council, 2013) requires producers who dehorn their cattle to "disbud calves as early as practically possible, while horn development is still at the horn bud stage (typically 2-3 months)." And to "use pain control, in consultation with a veterinarian to mitigate pain associated with dehorning calves after horn bud attachment."

Among producers who dehorn, significant regional variations exist regarding the age of calves at the time of dehorning. As shown in Figure 9, producers in the Eastern Provinces exhibit a higher percentage of producers who dehorn at or after weaning compared to western producers. Particularly noteworthy is that nearly half (36.8% to 48.1%) of all producers in Saskatchewan, Alberta, and British Columbia dehorn at spring processing, with most others dehorning shortly after birth as required by the *Beef Code of Practice* (National Animal Care Council, 2013). Compared to previous data, dehorning has shifted to later in the animal's life in Manitoba, Saskatchewan, and Eastern Canada, with more procedures occurring after weaning or at *other times*. The 2016-17 WCCCS II showed that of those producers who dehorn, 43-54% dehorned shortly after birth, 34-37.5% at spring processing, 9-10.5% at weaning, and 3-9% at *other times* (University of Saskatchewan, 2018).

FIGURE 9. TYPICAL TIMING FOR DEHORNING CALVES, BY PROVINCE



Source: 2022-23 CCCS (CCCS, 2024).

Improved pain mitigation techniques may be a deciding factor for when to dehorn. In every province, except Saskatchewan, producers have been increasing their use of pain mitigation during dehorning (Table 25). This has been a remarkable trend in the last 10 years, as the 2014 WCCCS data showed that 91% of producers did not use any pain mitigation during dehorning (Western Beef Development Centre, 2015).

The type of pain mitigation reported as used during dehorning in the 2022-23 CCCS has been consistent in Western Provinces, with most producers in the west using anti-inflammatory drugs ranging from 81.3 to 91.7%; (CCCS, 2024). In Ontario, anti-inflammatories were used by 53.6% of producers, an increase from the previous 17%. Local anesthetics plus anti-inflammatory were used by 36-39% of producers in Ontario, Québec and the Maritimes. Local anesthetics alone were previously used by just over one third of producers, but this value has fallen to 7.1% in more recent surveys. Producers in Québec and the Maritimes are the most frequent users of local anesthetics only (16%) (Figure 10).

Reported use of polled genetics is high (80.6%) and stable, reducing the need to dehorn. Under half of all producers in Saskatchewan (36.8%), Alberta (39.8%), and British Columbia (48.1%) dehorn at spring processing, with most others dehorning shortly after birth (CCCS, 2024), as required by the *Beef Code of Practice* (National Farm Animal Care Council, 2013). However, compared to previous data, dehorning has shifted to later in the animal's life in Manitoba, Saskatchewan, and Eastern Canada with most occurring after weaning or at *other times*.

In general, when producers do need to dehorn, they appear to be more aware of pain during the procedure and of the methods of treating the pain. The trend of treatment type in Western Canada appears stable. In every province, except Saskatchewan, producers have been increasing their use of pain mitigation during dehorning.

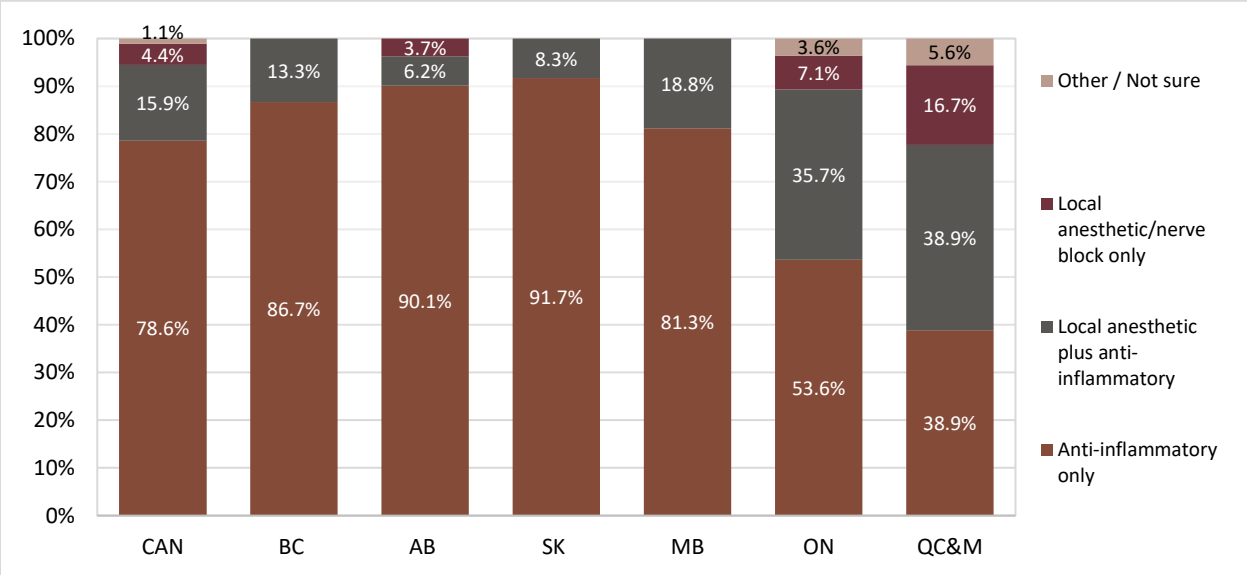
TABLE 25. PROPORTION OF PRODUCERS WHO NEVER USE PAIN MITIGATION WHEN DEHORNING

Region	2019 Adoption Rates Report (BCRC, 2019a) [a,b]	2022-23 Canadian Cow-Calf Survey (CCCS, 2024) [d]	Trend
Canada	-	29.8%	?
MT	50.0% [a]	14.3%	↓
QC	-		?
ON	48.33% [b]	20.0%	↓
MB	55.0% [c]	33.3%	↓
SK		54.5%	↔
AB		20.4%	↓
BC		37.5%	↓

Note: other response options included 'Yes depending on age and method' or 'Yes, all the time'.

Sources: [a] 2017 ACCS (Maritime Beef Council, 2018). [b] 2017 OCCS (University of Guelph, 2018); [c] 2016-17 WCCCS II (University of Saskatchewan, 2018); [d] 2022-23 CCCS (CCCS, 2024).

FIGURE 10. PAIN MITIGATION METHODS DURING DEHORNING



Source: 2022-23 CCCS (CCCS, 2024).

Insights for Knowledge Mobilization

Perceived Status: Close to peak adoption. Recommend supporting existing adoption with regular communications.

Within Western Canada, a decreasing trend is observed, with the use of pain mitigation during dehorning decreasing from 55.0% in the WCCCS II (University of Saskatchewan, 2018) to 49.5% in the 2022-23 CCCS (CCCS, 2024).

Within Eastern Canada, there is an increasing positive trend, with the use of pain mitigation during dehorning increasing from the previous range of from 50% in the 2017 ACCS (Maritime Beef Council, 2018) to 48.3% in the 2017 OCCS (University of Guelph, 2018) to 82.1% in the 2022-23 CCCS (CCCS, 2024).

Barriers: The most cited reason for not using pain mitigation in the 2022-23 CCCS was that dehorning was performed before the horn buds are attached to the skull (71.8%, CCCS, 2024). Financial concerns were reported by 11.5% of respondents, though this varies across provinces (CCCS, 2024). *Other* reasons, such as time and labour constraints or low perceived stress, account for 16.7% of responses overall (CCCS, 2024).

Resources: The *Beef Code of Practice* (National Animal Care Council, 2013) provides guidelines for proper disbudding and dehorning. BCRC *Pain Mitigation* (BCRC, 2024c) topic page. Also, the Government of Ontario's *Dehorning of Calves* (Government of Ontario, 2022) factsheet.

Opportunity: Continued efforts to increase producer awareness about the importance of dehorning and castrating calves as young as possible. This approach offers numerous benefits: it's easier for the operator and calves, less painful, creates a more minor wound, heals faster, and has less performance impact. Veterinarians should continue to emphasize the importance of pain mitigation during dehorning in their communications with producers.

CASTRATION

The *Beef Code of Practice* requires that calves be castrated as young as practically possible and for producers to use pain control, in consultation with a veterinarian, when castrating bulls older than six months of age (National Farm Animal Care Council, 2013). The 2022-23 CCCS shows that 84.5% of calves are castrated at less than three months old, and only 6.3% of producers typically castrate bull calves older than six months of age (CCCS, 2024). Timing of castration affects the choice of method, as banding is most common for calves under a week old, while surgery becomes increasingly more common for calves castrated between one week and three months. All provinces have trended towards earlier castration, with estimates as high as 93.8% of calves castrated before three months of age in Saskatchewan (CCCS, 2024).

Banding remains by far the most common form of castration nationwide, with surgery coming a distant second, and the clamp/Burdizzo method third. Notably, the clamp/Burizzo method saw a large drop in the Eastern Provinces. In Ontario, the use of clamp/Burdizzo fell from around 10% of producers using this method to 4.5%, and from 3-4% in the Maritimes and Québec to 1.8% (CCCS, 2024). This now aligns closer to practices in Western Provinces, where the clamp/Burdizzo method has slowly become obsolete.

Producers rate banding as the least painful method of castration, particularly if it is performed very early in the calf's life (Edwards-Callaway et al., 2023). In contrast to this perception, a recent review by Meléndez et al. (2025) reported that band castration induces both acute and prolonged pain due to inflammation that can persist for several weeks, whereas surgical castration is primarily associated with acute pain responses lasting up to seven days. Long term performance may be better after surgical castration, which may explain why this practice is recommended by a higher proportion of veterinarians (Fike et al., 2017). Considering that younger calves exhibit reduced pain responses, and that surgical castration results in short-term pain with faster healing compared to banding—with pain management being more effective for acute procedures—surgical castration performed within the first two months of life, accompanied by appropriate pain mitigation, is recommended (Meléndez et al. 2025). .

TABLE 26. PROPORTION OF PRODUCERS THAT CASTRATE BY TIMING OF CASTRATION

Region	2019 Adoption Rates Report (BCRC, 2019a)	2022-23 Canadian Cow-Calf Survey (CCCS, 2024) [d]	Trend
Canada	-	< 3 months – 84.5%, 3 - 6 months – 9.2%	?
	-	6 - 9 months – 4.5%, > 9 months – 0.5%, Never – 1.3%	?
MT	< 3 months - 69%, 3 - 6 months - 11% [a]	< 3 months - 75.9%, 3 - 6 months - 19.0%	↑
	> 6 months - 12%, Other - 7% [a]	6 - 9 months - 5.2%, > 9 months - 0.0%, Never - 0.0%	↓
QC	-	< 3 months - 75.9%, 3 - 6 months - 19.0%	?
	-	6 - 9 months - 5.2%, > 9 months - 0.0%, Never - 0.0%	?
ON	< 3 months – 52.44%, 3 - 6 months – 10.98% [b]	< 3 months - 67.0%, 3 - 6 months - 17.6%	↑
	> 6 months – 25.61%, Other – 10.98% [b]	6 - 9 months - 12.1%, > 9 months - 2.2%, Never - 1.1%	↓
MB	< 3 months - 64-94%, 3 - 6 months - 4-30%, > 6 months - 2-25%, Other - 1-11% [c]	< 3 months - 89.5%, 3 - 6 months - 7.0%	↔
		6 - 9 months - 3.5%, > 9 months - 0.0%, Never - 0.0%	↓
SK		< 3 months - 93.8%, 3 - 6 months - 4.7%	↑
		6 - 9 months - 0.8%, > 9 months - 0.0%, Never - 0.9%	↓
AB		< 3 months - 86.3%, 3 - 6 months - 6.2%	↑
		6 - 9 months - 4.7%, > 9 months - 0.5%, Never - 2.4%	↓
BC		< 3 months - 88.9%, 3 - 6 months - 9.3%	↑
		6 - 9 months - 0.0%, > 9 months - 0.0%, Never - 1.9%	↓

Sources: [a] 2017 ACCS (Maritime Beef Council, 2018); [b] 2017 OCCS (University of Guelph, 2018); [c] 2016-17 WCCCS II (University of Saskatchewan, 2018); [d] 2022-23 CCCS (CCCS, 2024).

Providing pain relief during castration has increased across the country with an average of 26.2% of producers using pain mitigation all the time, and 20.4% using depending on age and method. The lowest reported rates of use of pain mitigation occurs in Saskatchewan and Manitoba (Table 28).

In Western Canada the proportion of producers who never use pain mitigation during castration ranges between 46.6% to 65.6% compared to 72-96% in the 2016-17 WCCCS II (University of Saskatchewan, 2018). While in Eastern Canada the proportion of producers who never use pain mitigation during

castration ranges between 48.4% to 50% in 2022-23 (CCCS, 2024) compared to 74-90% in previous surveys (University of Guelph, 2018).

TABLE 27. PROPORTION OF PRODUCERS THAT CASTRATE BY METHOD OF CASTRATION

Region	2019 Adoption Rates Report (BCRC, 2019a)	Canadian Cow-Calf Survey (2024) [g]	Trend
Rubber Band			
MT	82% [a]	84.2%	↑
QC	94% [b]		↓
ON	66.2-79% [bc]	84.2%	↑
MB	80.7% [d]	81.8%	↑
SK		87.7%	↑
AB		81.1%	↔
BC		76.0%	↔
Surgical			
MT	9% [a]	1.8%	↓
QC	3% [b]		↓
ON	11-19.98% [bc]	1.8%	↓
MB	15% [d]	4.5%	↓
SK		1.8%	↓
AB		0.0%	↓
BC		0.5%	↓
Clamp/Burdizzo			
MT	4% [a]	1.8%	↓
QC	3% [b]		↓
ON	10 -10.11% [bc]	1.8%	↓
MB	5% [d]	4.5%	↓
SK		1.8%	↓
AB		0.0%	↓
BC		0.5%	↓

Sources: [a] 2017 ACCS (Maritime Beef Council, 2018); [b] Northern Ontario and Northern Quebec Cow-Calf Production (Lamothe and North Haven Solutions, 2018); [c] 2017 OCCS (University of Guelph, 2018); [d] 2016-17 WCCCS II (University of Saskatchewan, 2018); [e] 2022-23 CCCS (CCCS, 2024).

Producers have recognized that there is significant pain associated with castration and have been changing practices to minimize pain. Changing castration methods and providing pain relief have both increased since the 2019 Adoption Rates report (BCRC, 2019a) was published. Younger calves that are banded show the fewest signs of physical pain, which likely explains the popularity of castrating at younger ages (Johnstone et al., 2021). While an increasing number of producers are using pain mitigation, it is more commonly used on older calves. Waldner et al. (2022) found that 26% of respondents are providing anti-inflammatory drugs during calf spring processing.

TABLE 28. PROPORTION OF PRODUCERS THAT TREAT FOR PAIN DURING CASTRATION

Region	2019 Adoption Rates Report (BCRC, 2019a)	2022-23 Canadian Cow-Calf Survey (CCCS, 2024) [e]	Trend
Canada	-	Yes, all the time - 26.2%, Yes, depending on time/method - 20.4%, No - 53.4%	?
MT	Yes, all the time - 0%, Yes, depending on time/method - 10%, No - 90% [a]	Yes, all the time - 17.2%, Yes, depending on time/method - 32.8%, No - 50.0%	↑
QC	Yes, all the time - 6%, Yes, depending on time/method - 3%, No - 84% [b]		↑
ON	Yes, all the time - 9%, Yes, depending on time/method - 26%, No - 74% - 84% [b&c]	Yes, all the time - 24.2%, Yes, depending on time/method - 26.4%, No - 48.4%	↑
MB	Yes, all the time - 13%, Yes, depending on time/method - 15%, No - 72% [d]	Yes, all the time - 17.5%, Yes, depending on time/method - 19.3%, No - 63.2%	↑
SK		Yes, all the time - 22.7%, Yes, depending on time/method - 11.7%, No - 65.6%	↑
AB		Yes, all the time - 32.5%, Yes, depending on time/method - 20.9%, No - 46.6%	↑
BC		Yes, all the time - 32.1%, Yes, depending on time/method - 17.0%, No - 50.9%	↑

Sources: [a] 2017 ACCS (Maritime Beef Council, 2018); [b] Northern Ontario and Northern Quebec Cow-Calf Production (Lamothe and North Haven Solutions, 2018); [c] 2017 OCCS (University of Guelph, 2018); [d] 2016-17 WCCCS II (University of Saskatchewan, 2018); [e] 2022-23 CCCS (CCCS, 2024).

Fike et al. (2017) found that of the veterinarians surveyed, and who serve cow-calf operations in the U.S. and Canada, overwhelmingly recommend surgical castration. Of the veterinarians surveyed, 86% ranked surgical castration as their preferred method at branding, and 67% ranked surgical castration as their preferred method at weaning. In comparison, banding was preferred by 11% of veterinarians surveyed at branding, and by 25% of veterinarians surveyed at weaning. This may explain some of the increase in this method in Eastern Canada, though it is far behind banding in popularity. Physical indicators of pain appear more obvious in calves that were surgically castrated, especially within the first few days, but positive outcomes (e.g., lower incidence of infections) are more likely with the surgical method (Fike et al., 2017).

Insights for Knowledge Mobilization

Perceived Status: Close to peak adoption. Recommend supporting existing adoption with regular communications.

Within both Western and Eastern Canada, the use of pain mitigation has increased in a positive trend. Western Canadian producers use of pain mitigation during castration has increased from 28% reported in the 2016-17 WCCCS II (University of Saskatchewan, 2018) to 45% reported in the 2022-23 CCCS (CCCS, 2024). Eastern Canada producers' use of pain mitigation during castration has increased from a 9-35% range as reported in the 2017 ACCS (Maritime Beef Council, 2018), the OCCS (University of Guelph, 2018), and the Northern Ontario and Northern Quebec Cow-Calf Production (Lamothe and North Haven Solutions, 2018) to 51% in the 2022-23 CCCS (CCCS, 2024).

Barriers: The primary reason for not using pain mitigation, was those calves were castrated before three months old (87% of respondents), followed by financial concerns (4.1%), though this varies across provinces. *Other* reasons, such as perceived low stress or pain as castration happens within 48 hours after birth, accounted for 8.9% of responses in the 2022-23 CCCS (CCCS, 2024).

Resources: The *Beef Code of Practice* recommends seeking guidance from a veterinarian on the optimum method and timing of castration, as well as the availability and advisability of pain control for castrating beef cattle (National Farm Animal Care Council, 2013). The code also recommends to castrate calves as young as practically possible. BCRC *Pain Mitigation* (BCRC, 2024c) topic page.

Opportunity: Collaborate with veterinarians to provide consistent messaging.

PRODUCTIVITY

Cow-calf producers are paid for the pounds of calves they wean. Once a live calf is born, the goal is to promote weight gain as efficiently and affordably as possible. However, aiming solely for the highest possible weaning weights can reduce profitability if the extra gain comes with disproportionately higher feed, labour, or management costs. This requires optimizing the genetics within the herd to achieve a bent growth curve between birth and weaning. A bent growth curve refers to a nonlinear pattern of weight gain where calves grow slowly at first, accelerate rapidly during a peak growth phase, and then slow again as they approach weaning. The objective is to balance growth potential with input requirements, ensuring that weaning weights are optimized rather than maximized.

Potential practices for productivity include:

- ***Implanting.*** Utilizing pre-weaning implanting to optimize feed efficiency and calf pounds sold to support profitability.
- ***Low-stress Weaning*****.** Low-stress weaning reduces bawling, stress, and weight loss while supporting short-term weight gain and lower treatment rates.
- ***Retained Ownership*****.** Allows producers to sell calves into a different market and add pounds to sell.

GROWTH

Growth is reported as weaning weight or adjusted weaning weight, expressed as a percentage of the mature cow's weight. Ideally, the 205-day adjusted weaning weight should be between 40% and 45% of the mature cow's weight (BCRC, 2019a). At the national level, this indicator is on the low end of the target range, at 39.5%, suggesting that cow weights are rising faster than weaning weights.

The average weaning weights reported for steers and heifer calves born to heifers were 571 lbs and 531 lbs, respectively, with a combined average weight of 551 lbs. The 205-day adjusted weaning weight was reported as 537 lbs in the 2022-23 CCCS (CCCS, 2024). Average weaning weights have decreased in all regions compared to the 2019 Adoption Rates Report (BCRC, 2019a). In the 2022-23 CCCS, 42% of respondents reported actual weaning weights, while the remainder were estimated weights (CCCS, 2024).

The highest average cow weights were reported in Eastern Canada, with Ontario averaging 1,432 lbs, and 1,428 lbs in Québec and the Maritime provinces. This corresponds to slightly higher calf weaning weights in Ontario (CCCS, 2024). The highest percentage of 205-day adjusted weaned calf to mature cow weights is Alberta at 41.2%, and the lowest are in Saskatchewan, and Quebec and the Maritimes are at 39.9% and 37.3%, respectively (CCCS, 2024).

TABLE 29. AVERAGE CALF WEANING WEIGHT

Region	2019 Adoption Rates Report (BCRC, 2019a)	2022-23 Canadian Cow-Calf Survey (CCCS, 2024) [d]	Trend	205-day adjusted Weaning Weight as % of Cow Weight (CCCS, 2024)
MT	659 lb male; 596 lb female [a]	604 lb male; 556 lb female	↓	37.3%
QC	607-708 lb male; 589-680 lb female [b]		↓	
ON	444-587 lb male; 360-534 lb female (N. Ontario) [b]	621 lb male; 571 lb female	↓	38.3%
MB	611 lb steer; 662 lb bull calves; 584 lb heifer [c]	600 lb male; 552 lb female	↓	37.9%
SK		582 lb male; 533 lb female	↓	40.5%
AB		607 lb male; 558 lb female	↓	41.2%
BC		590 lb male; 551 lb female	↓	40.9%

Sources: [a] 2017 ACCS (Maritime Beef Council, 2018); [b] Northern Ontario and Northern Québec Cow-Calf Production (Lamothe and North Haven Solutions, 2018); [c] 2016-17 WCCCS II (University of Saskatchewan, 2018); [d] 2022-23 CCCS (CCCS, 2024).

Insights for Knowledge Mobilization

Perceived Status: Below target. Recommend targeting with knowledge mobilization materials.

Western Canada exhibits a decreasing negative trend, with weaning weights for steers dropping from 611 lbs in the 2016-17 WCCCS II (University of Saskatchewan, 2018) to 577 lbs in the 2022-23 CCCS (CCCS, 2024). Similarly, weaning weights for heifers decreased from 584 lbs in the WCCCS II (University of Saskatchewan, 2018) to 530 lbs in the more recent CCCS (CCCS, 2024).

Eastern Canada also experienced a decreasing negative trend in male calf weaning weights. Weights dropped from 596 lbs in the 2017 ACCS (Maritime Beef Council, 2018), 444-708 lbs in the 2017 Northern Ontario and Northern Québec study (Lamothe and North Haven Solutions, 2018), 685 lbs in the 2017 OCCS (University of Guelph, 2018) to 561 lbs in the 2022-23 CCCS (CCCS, 2024). Heifer weaning weights also exhibited a decreasing negative trend, with reported values of 596 lbs in the 2017 ACCS (Maritime Beef Council, 2017), 360-680 lbs in the 2017 Northern Ontario and Northern Québec study (Lamothe and North Haven Solutions, 2018), 636 lbs in the 2017 OCCS (University of Guelph, 2018) to 516 lbs in the 2022-23 CCCS (CCCS, 2024).

Barriers: An emphasis on avoiding undesirable outcomes such as calving difficulty, sub-optimal open rates, and higher death loss does not have to come at the expense of lower weaning weights. While producers must consider trade-offs when making decisions suitable for their operation, they should recognize that selecting for calving ease does not have to come at the cost of weaning weights.

Resources: The *Cow-Calf Production Indicator Tool* (BCRC, n.d.-d) allows producers to enter their own data (only 15 data points needed) to compare against provincial averages from the CCCS (CCCS, 2024). Fact sheet on optimizing productivity, including weaning weights, Moving a cowherd towards optimum productivity.

Opportunities: Effective communication is needed to demonstrate how management practices can optimize the genetic potential within a herd. This optimization will help bend the growth curve, leading to the recommended 40-45% weaning weight relative to mature cow weight. This approach offers

additional benefits by optimizing feed utilization, ensuring an operation produces the most pounds possible. Genetic selection and crossbreeding can also contribute to achieving a bent growth curve. Selecting bulls and replacement heifers with desirable traits such as fertility, growth efficiency, carcass quality, and adaptability to environmental conditions (Garrick & Golden, 2009) will support weaning weights. A key contributing factor to weaning weight is the milking and mothering ability of the dam, which is related to the dam's ability to maintain optimal body condition throughout the production cycle. There can be a 5-25% reduction in the adjusted 205-day weaning weight for calves from dams with a body condition of less than 2.0 at calving and or that lose 0.5 body condition pre-calving (Alberta Agriculture and Food, 2008). Pasture conditions, impacting nutrition of both the dam and calf, could have been a factor during the 2022-23 CCCS, as drought conditions persisted in Western Canada. Furthermore, clean water directly supports feed intake, which in turn increases weight gain. Utilizing off-site water systems is key; these systems allow sediment to settle and prevent fecal contamination, thereby supporting healthier weaning weights.

IMPLANTING

Implanting improves *average daily gain* (ADG) and offers a relatively high return on investment when used correctly. Implanting suckling calves at branding can enhance average daily gain between branding and weaning, resulting in additional 23 pounds of sale weight every fall (Selk, 1997). Studies have consistently shown that suckling calves that are implanted will have a competitive weight advantage with no loss of subsequent performance in later production phases (Laudert & Matsushima, 1981; Pritchard et al., 2003). Research has consistently shown that implanting suckling calves has a positive *Return on Investment* (ROI) for cow-calf producers.

Nationally, the use of growth implants has remained steady between 2017 and 2021 at 14% as reported in the 2021 FMS (CRS, 2024). Implants are far more common on the Prairies, with an estimated third of producers in Alberta and Saskatchewan now utilizing them. This east-west difference was also highlighted by Lazurko et al. (2024), where western herds were six times more likely to be implanted compared to eastern herds.

Because the sample size for producers using implants was small, the calculated proportion of implanted calves may differ from the true proportion of producers who implant their calves. For example, the 2022-23 CCCS reported no producers in Québec, the Maritimes, Manitoba, or British Columbia reported implanting all calves in their herds, but in other provinces the proportion of producers adopting this practice in all calves could be as high as 31.8% (CCCS, 2024).

TABLE 30. PROPORTION OF PRODUCERS THAT IMPLANT

Region	2019 Adoption Rates Report (BCRC, 2019a)	2022-23 Canadian Cow-Calf Survey (CCCS, 2024) [e]	Trend
Canada	-	24.7%	?
MT	0.24% [a]	10.3%	↑
QC	-		?
ON	2.4% [b]	5.5%	↑
MB	24-26.5% [c,d]	19.3%	↓
SK		38.8%	↑
AB		33.6-42.9% [e,f]	↑
BC		9.3%	↓

Sources: [a] 2017 ACCS (Maritime Beef Council, 2018); [b] 2017 OCCS (University of Guelph, 2018); [c] 2013-14 WCCCS (Western Beef Development Centre, 2015); [d] 2016-17 WCCCS II (University of Saskatchewan, 2018); [e] 2022-23 CCCS (CCCS, 2024); [f] AALL Survey (AALL, 2024).

Insights for Knowledge Mobilization

Perceived Status: Below target. Recommend targeting with knowledge mobilization materials.

Within Canada, there is an increasing positive trend for the use of implants; however, adoption is low, especially outside Alberta and Saskatchewan. In Western Canada, implanting has trended up from 26.5% in the 2016-17 WCCCS II (University of Saskatchewan, 2018) to 30.4% in the 2022-23 CCCS (CCCS, 2024). In Eastern Canada, the practice has trended up from 0.24-2.4% as reported in the ACCS (Maritime Beef Council, 2018) and the OCCS (University of Guelph, 2018) to 7.4% as reported in the CCCS (CCCS, 2024).

Barriers: Reasons for not using implants were wide-ranging, but they fit into three main themes: lack of economic returns, philosophical opposition, and lack of knowledge (CCCS, 2024). Reasons for not adopting the practice included lack of perceived positive economic returns (18.1%), preference to market through a natural program (14.5%), and getting a better price without implants (7.8%) (CCCS, 2024).The literature suggests that price premiums for unimplanted calves are often insufficient to offset the economic gains lost by forgoing implant use (Maxwell et al., 2015). Misaligned incentives may also play a role, as benefits may be more apparent for feeders than cow-calf producers.

Resources: Government of Manitoba *Implanting Information* page (Government of Manitoba, n.d.).

Opportunities: The top reason stated for not adopting implants was philosophical opposition to the practice (22.6% of non-adopters). Understanding what is behind that philosophical opposition could help inform knowledge mobilization. Other reasons cited for not adopting the practice included not knowing how to implant (8.5%), being unsure of which implant to use (4.3%), and *other reasons* (17.7%). These responses suggest there are still knowledge gaps with respect to implanting.

A cost-benefit tool for cattle producers, specifically addressing compensatory gain from pre-weaning implants, would be highly valuable, especially given the current high calf prices. These high prices might mask underlying inefficiencies, making a comprehensive tool even more critical for long-term sustainability. There is an additional opportunity to increase weaning weight as a percentage of mature cow weight by communicating the ROI of implant use at spring processing to producers who already implant backgrounded feeders but not calves.

LOW-STRESS WEANING

The proportion of calves that are weaned using traditional separation has decreased in every region except Saskatchewan, where producers have remained relatively consistent with weaning practices since the last set of surveys. Natural weaning has also been reduced in most regions outside the Maritimes and Québec. Natural weaning is the longest method of weaning, putting additional stress on the dam.

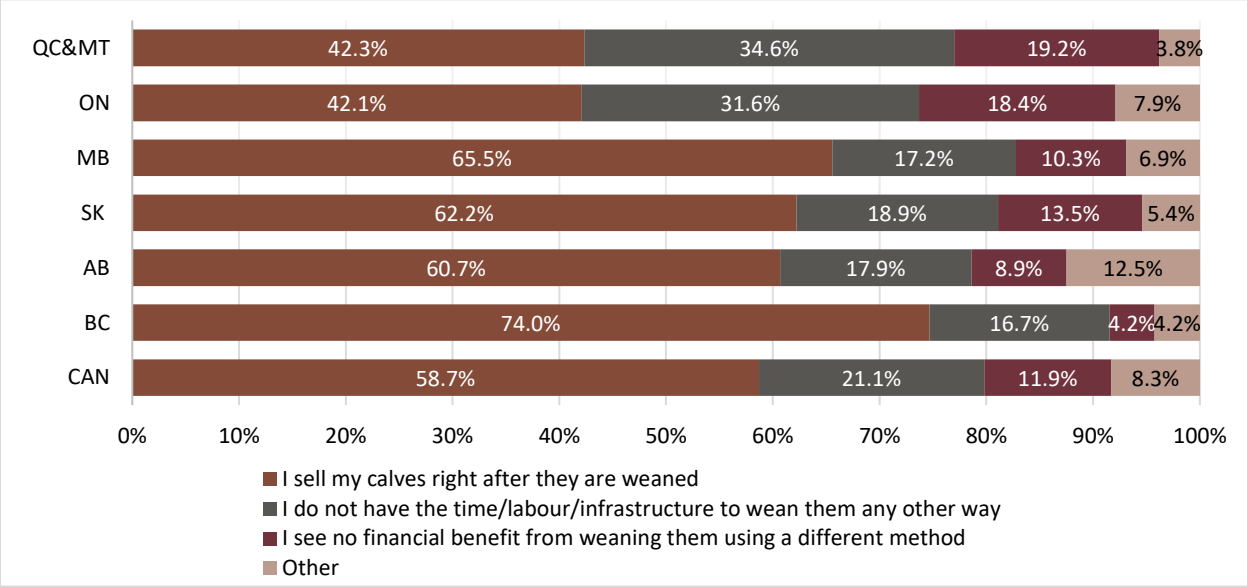
Fence-line weaning continues to be a more popular choice than nose paddles. This could be due to the labour required for nose paddle weaning, and the incidence of nose sores of calves, as reported anecdotally by some producers. Nose-paddles were the least popular in regions with larger herds, such as Alberta and Saskatchewan. In addition, recent studies have shown better performance following fence-line weaning compared to traditional and nose paddle weaning. In terms of calf welfare, all these methods are better at reducing stress and improving performance compared to traditional separation or abrupt weaning (Taylor et al., 2020).

TABLE 31. PROPORTION OF PRODUCERS BY WEANING METHOD

Region	2019 Adoption Rates Report (BCRC, 2019a)	2022-23 Canadian Cow-Calf Survey (CCCS, 2024) [e]	Trend	2019 Adoption Rates Report (BCRC, 2019a)	2022-23 Canadian Cow-Calf Survey (CCCS, 2024) [e]	Trend
Traditional Separation				**Natural Weaning**		
MT	59% [a]	44.8%	↓	2% [a]	5.2%	↑
QC	67% [b]		↓	1% [b]		↑
ON	54-60% [bc]	41.8%	↓	5% [b]	2.2%	↓
MB	49% [d]	50.9%	↔	3.0% [d]	1.8%	↓
SK		57.4%	↑		0.8%	↓
AB		53.3%	↑		1.9%	↓
BC		46.3%	↓		1.9%	↓
Fence-line				**Nose Paddle**		
MT	17% [a]	31.0%	↑	20% [a]	17.2%	↓
QC	23% [b]		↑	2% [b]		↑
ON	22-23% [bc]	35.2%	↑	5-14% [bc]	16.5%	↑
MB	35% [d]	28.1%	↓	11.0% [d]	14.0%	↑
SK		31.0%	↓		7.8%	↓
AB		33.3%	↔		9.0%	↓
BC		33.3%	↔		16.7%	↑
Other				-		
MT	4% [d]	1.7%	↓			
QC			↓			
ON		4.4%	↔			
MB		5.3%	↑			
SK		3.1%	↓			
AB		2.4%	↓			
BC		1.9%	↓			

Sources: [a] 2017 ACCS (Maritime Beef Council, 2018); [b] Northern Ontario and Northern Québec Study (Lamothe and North Haven Solutions, 2018); [c] 2017 OCCS (University of Guelph, 2018); [d] 2016-17 WCCCS II (University of Saskatchewan, 2018); [e] 2022-23 CCCS (CCCS, 2024).

FIGURE 11. TOP REASONS FOR USING TRADITIONAL SEPARATION BY PROVINCE



Source: 2022-23 CCCS (CCCS, 2024).

Insights for Knowledge Mobilization

Perceived Status: Improving, but low adoption. Strategy recommended is to increase depth of adoption.

There is a steady trend in the adoption of low-stress weaning methods across Canada. Within Western Canada, the use of nose pad two-stage weaning went from 11% as reported in the 2016-17 WCCCS II (University of Saskatchewan, 2018) to 10% reported in the 2022-23 CCCS (CCCS, 2024), and fence line weaning decreased from 35% reported in the WCCCS II (University of Saskatchewan, 2018) to 32% reported in the CCCS (CCCS, 2024). In Eastern Canada, the use of nose pad two-stage weaning has trended from 2-20% in 2016 and 2017 studies (Maritime Beef Council, 2018; Lamothe and North Haven Solutions, 2018; University of Guelph, 2018) to 17% in the 2022-23 CCCS (CCCS, 2024). During the same time periods, the use of fence line weaning increased from 17-23% (Lamothe and North Haven Solutions, 2018; Maritime Beef Council, 2018; University of Guelph, 2018) to 34% (CCCS, 2024).

Barriers: Producers from Eastern Canada reported their top reasons for using traditional separation to be concerns about time, labour and infrastructure requirements, and lack of financial benefit. However, most producers who use traditional (abrupt) separation do so because they sell immediately after weaning (CCCS, 2024). Traditional separation is used for convenience by most producers, particularly if they are bringing pairs home from a community pasture or spring grazing.

Resources: BCRC has a *Weaning* (BCRC, 2019c) topic page.

Opportunity: Continue communicating about the benefits of low-stress weaning practices for calf health through other mediums that have a greater reach to producers.

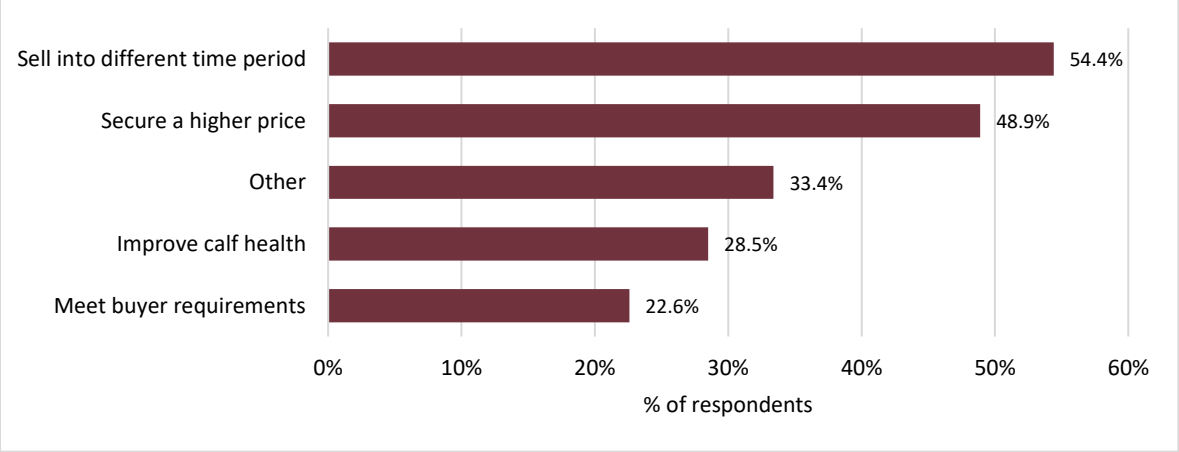
RETAINED OWNERSHIP

Retaining ownership through the backgrounding and feedlot phases allows producers to sell into a different market, capture data on individual animal performance, facilitate informed breeding, and make selection decisions to drive genetic improvement in their own herd. However, this approach requires careful consideration of market trends, production costs, and risks to ensure its success (White et al., 2007). Often, late calving operations may see greater benefits from practices such as retained backgrounding after weaning to increase sale weight and gross margin (Kruse et al., 2008).

Approximately 40% of respondents retained ownership of their calves after weaning to strategically market their livestock at a more favourable time (54.4%) and to command a premium price (49.0%). Additional key motivations include enhancing calf health outcomes (28.5%) and meeting specific buyer specifications (22.6%) (Figure 12).

Beyond these primary drivers, a significant proportion of respondents (approximately one-third) in the *other* category cited diverse, specialized reasons for retaining ownership. These motivations encompass innovative marketing approaches (e.g., direct-to-consumer sales, niche market targeting, and grass-finishing strategies, etc.). Others focus on genetic advancement through data-driven breeding decisions, while some prioritize operational objectives like expanding herd size, optimizing pasture utilization, and effective manure management.

FIGURE 12. TOP REASONS FOR RETAINING OWNERSHIP



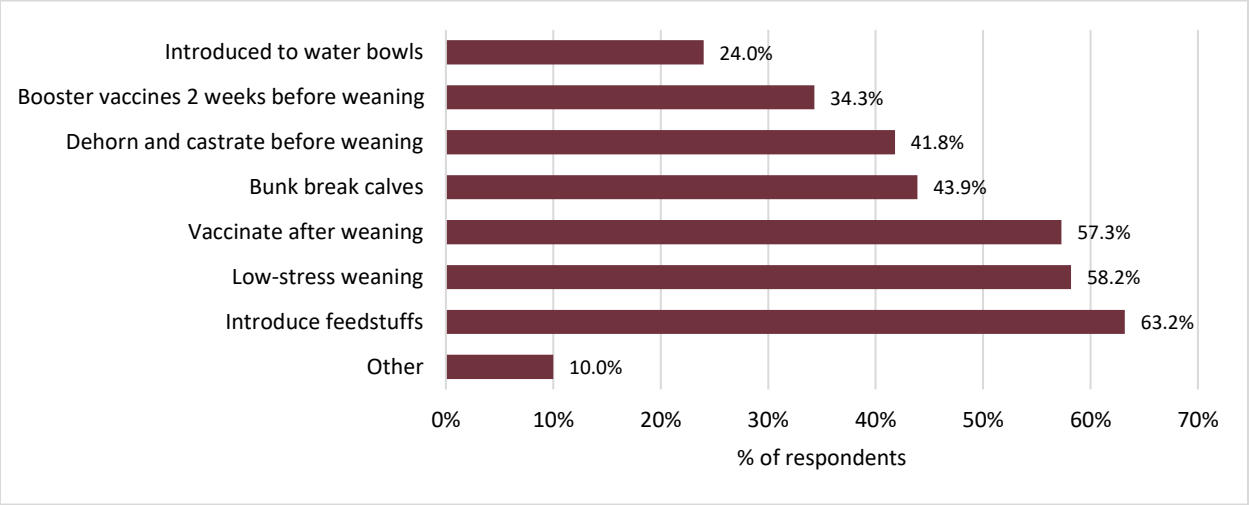
Source: 2022-23 CCCS (CCCS, 2024).

Canadian cow-calf producers who retained ownership of their calves post-weaning implemented various practices to minimize weaning stress and ensure their calves had the best possible start (Figure 13).

Pre-conditioning is a management method to reduce stress and disease susceptibility and prepare calves to enter the feedlot. Preconditioned calves are weaned at least 30-60 days prior to sale, vaccinated, introduced to feedstuffs, feed bunks, and water bowls. The idea is to spread out the stressors that calves experience including, weaning, vaccination, transportation, co-mingling, and dietary and environmental changes to minimize stress and not overwhelm the immune system. Studies have shown that preconditioned calves have a lower cost of gain at the feedlot, higher gain rates, and better feed efficiency, as well as lower treatment rates and death loss (Lalman & Ward, 2005).

Of the producers who retain ownership, only one-third meet all the requirements of pre-conditioning. This indicates that the focus of retaining ownership is adding more pounds to sell and selling into a different market.

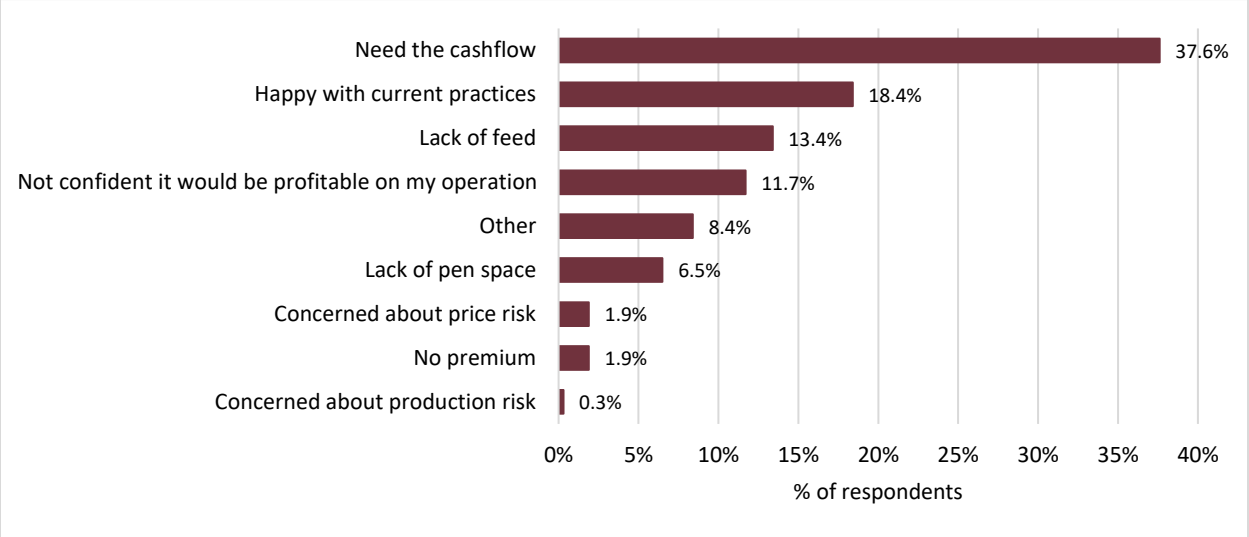
FIGURE 13. PRACTICES PERFORMED DURING RETAINED OWNERSHIP



Source: 2022-23 CCCS (CCCS, 2024).

Figure 14 shows the main reason for not retaining calves was the need for cash flow (37.6%). *Other* reasons (8.4%) included limited land or water availability, lack of affordable feeding, timing to get the best prices per pound, and personal factors such as approaching retirement.

FIGURE 14. RESPONDENT REASONS FOR NOT RETAINING OWNERSHIP



Source: 2022-23 CCCS (CCCS, 2024).

***Insights for* Knowledge Mobilization**

Perceived Status: Niche Practice. Recommend that knowledge mobilization resources be available for producers to learn about these practices, and for adoption be monitored. But recognize that the practice is only suitable and of interest to a subset of producers.

The 2022-23 CCCS found that around 60% of respondents sold at weaning, with the remaining 40% retaining ownership of their calves (CCCS, 2024). Within Western Canada, there is a downward negative trend for the adoption of retained ownership, with trends from 45% reported in the WCCCS II (University of Saskatchewan, 2018) to 38.4% reported in the CCCS, (CCCS, 2024).

In Eastern Canada, the historical trend is unknown and current adoption is at 44.3% (CCCS, 2024).

Barriers: Over one-third of producers identified cashflow as a reason for selling (37.6%), followed by being happy with current practices at 18.4% (Figure 14) (CCCS, 2024).

Resources: BCRC has a *Preconditioning* (BCRC, 2025e) topic page and decision-making tool on the *Value of Preconditioning and Backgrounding Calculator* (BCRC, n.d.-h).

Opportunities: Strategic communications with scenarios utilizing the *Value of Preconditioning and Backgrounding Calculator* (BCRC, n.d.-h) in years when it makes sense for producers to retain ownership.

ANIMAL HEALTH MANAGEMENT

A strong herd health program reduces treatment costs and improves survival and growth rates.

Potential practices for animal health management include:

- ***Vaccination*.** Follow a strategic vaccination protocol for respiratory, clostridial, and reproductive diseases.
- ***Appropriate Remote Drug Delivery (RDD)*.** In cases where traditional delivery is not possible, (such as remote locations without handling facilities or when dealing with difficult animals) devices such dart guns, pole syringes and crossbows designed for administering injections can be used to ensure effective drug delivery along with avoiding bruising and injection site lesions in high quality cuts.
- ***Deworming and Parasite Control*.** Use strategic deworming based on fecal egg counts to prevent resistance.
- ***Veterinary Communication*.** The National Farm Animal Care Council (2013) recommends all livestock producers have an ongoing *veterinarian-client-patient relationship* (VCPR) with a licensed practicing veterinarian and develop a strategy for disease prevention and herd health.

VACCINATION

Vaccinations are part of a herd health program that prime the immune system as the first line of defense for a herd. It is recommended that breeding females be vaccinated to protect them from reproductive disease and their calves from respiratory disease. Sanguinetti et al. (2024) found that veterinary experts agree - giving clostridial vaccines to pre-weaned calves is a practice that is "always useful for all herds". Additional vaccination recommendations vary depending on the region and the farm, as disease prevalence and production and management practices can either increase or decrease the level of risk to which cattle are exposed.

The 2022-23 CCCS shows the vast majority (94%) of respondents vaccinate at least one class of cattle for at least one disease (CCCS, 2024, Table 32). By province, the values generally show higher vaccination rates compared to 2017 survey results.

TABLE 32. GENERAL HERD LEVEL VACCINATION LEVELS

Region	2019 Adoption Rates Report (BCRC, 2019a)	2022-23 Canadian Cow-Calf Survey (CCCS, 2024) [e]	Trend
Canada	-	94%	?
MT & QC	72% [a]	91.4%	↑
	72% [b]		
ON	70% [b] 84% [c]	92.3%	↑
MB	95% [d]	93%	↓
SK		95.3%	↑
AB		95.3%	↑
BC		92.6%	↓

Sources: [a] 2017 ACCS (Maritime Beef Council, 2018); [b] Northern Ontario and Northern Québec Study (Lamothe and North Haven Solutions, 2018) (cows only); [c] 2017 OCCS (University of Guelph, 2018); [d] 2016-17 WCCCS II (University of Saskatchewan, 2018); [e] 2022-23 CCCS (CCCS, 2024).

Nationally, 68.2% of respondents reported vaccinating their females pre-calving, with the highest adoption in Ontario (71.8%) and Saskatchewan (70.1%) (CCCS, 2024). Vaccines for clostridial disease (e.g., blackleg), reproductive disease and BRD vaccines were most commonly given to cows, replacement heifers, bulls, and calves (CCCS, 2024, Table 33). Meanwhile, scours and vibrio/lepto vaccines were less frequently administered across herds nationally. Clostridial (84.7%) and BRD (73.4%) vaccines were most commonly administered to calves nationwide (CCCS, 2024).

TABLE 33. NATIONAL AVERAGE FOR TYPES OF VACCINES USED BY ANIMAL CLASS

Vaccination	Cows	Replacement Heifers	Bulls	Calves	None
7, 8, or 9-way Clostridial Disease	66.1%	78.2%	53.4%	84.7%	1.6%
Reproductive Diseases	69.3%	71.8%	45.2%	46.8%	8.9%
Bovine Respiratory Disease (BRD)	65.8%	70.7%	46.1%	73.4%	5.1%
Scours	39.0%	34.4%	2.3%	22.3%	24.6%
Vibro/Lepto	26.2%	24.1%	14.2%	8.5%	37.5%
Other	3.o%	2.3%	6.2%	3.0%	5.0%

Source: 2022-23 CCCS (CCCS, 2024).

Across provinces, Québec and the Maritimes reported the lowest vaccination rates for cows against clostridial diseases (42.1%), reproductive diseases (55.2%), scours (26.3%), and vibrio/lepto (15.8%) (CCCS, 2024, Table 34).

Current adoption rates for scours vaccines in breeding females from Québec and the Maritimes (26.3% for cows and 21.1% for replacement heifers - CCCS, 2024) are lower than the previous survey at 35% (Maritime Beef Council, 2018). Current scours vaccination rates for cows also shows lower adoption rates in Western Canada compared to the WCCCS II (University of Saskatchewan, 2018) (Table **34**).

One potential factor influencing the recent decline in Canadian cattle vaccination rates could be supply chain disruptions, particularly regarding the availability of key livestock vaccines, such as those used for scours prevention. These disruptions may have stemmed from manufacturing delays, logistical challenges, or prioritization of human health products during the COVID-19 pandemic. However, supply issues alone may not fully explain the observed trend. Other contributing factors could include shifts in producer perceptions of vaccine effectiveness, regional differences in disease prevalence, cost concerns, or changes in veterinary access and recommendations. Further investigation is needed to determine the relative impact of these factors.

The C3SN survey results, as presented by Lazurko et al. (2023), showed a higher overall vaccination rate in Western Canada compared to Eastern Canada. For example, 68% of Western Canadian producers vaccinated calves against clostridial disease, compared to 33% in Eastern Canadian producers. Similarly, 55% of cows from western herds were vaccinated for scours, versus 48% in eastern herds (Lazurko et al., 2023). In contrast, vaccination for reproductive diseases such as *Campylobacter fetus* and *Leptospira spp.* was more common in Eastern Canada than in the Western Canada, reported at 48% and 33%, respectively (Lazurko et al., 2023). These trends are consistent with findings from both the 2020 C3SN survey results (Waldner et al., 2024) and the CCCS (CCCS, 2024). These surveys also reported a relatively stable clostridial vaccine adoption in Western Canada.

The C3SN clostridial vaccination rates for Ontario producers were lower than in Western Canada (Lazurko, et al., 2023), and these results hold in the 2022-23 CCCS (CCCS, 2024). Lazurko et al. (2023) also noted

that overall cow herd vaccination rates were higher for Eastern Canada from 2015-16 to 2020 but remained stable for Western Canada.

TABLE 34. TREND FOR TYPES OF VACCINES USED IN COWS AND CALVES

Region	Vaccinating Cows Reproductive Diseases			Vaccinating Cows Scours			Vaccinating Calves Clostridial			Vaccinating Calves Respiratory		
	Past	Current	Trend	Past	Current	Trend	Past	Current	Trend	Past	Current	Trend
MT	-	55.2%	?	35% [a]	26.3%	↓	-	81.6%	?	-	92.1%	?
QC	-		?	-		?	-		?	-		?
ON	30% Vibriosis, 59% Lepto, 67% BVD [b]	80.5%	↑	30% [b]	42.9%	↑	-	85.7%	?	-	58.4%	?
MB	73.9% [c]	80%	↑	66% [c]	50%	↓	93% [c]	88%	↓	BRD 84%, BRSV/BVD 77.1% [c]	68%	↓
SK		71.7%	↓		38.3%	↓		92.5%	↔		71.7%	↓
AB		73.7%	↔		41.9%	↓		92.4%	↔		77.3%	↓
BC		76.6%	↑		48.9%	↓		70.2%	↓		87.2%	↑

Sources: [a] 2017 ACCS (Maritime Beef Council, 2018) [b] 2017 OCCS (University of Guelph, 2018) [c] 2016-17 WCCCS II (University of Saskatchewan, 2018); 2022-23 CCCS (CCCS, 2024).

TABLE 35. TYPES OF VACCINES, BY ANIMAL TYPE IN THE NATIONAL BEEF CATTLE SURVEILLANCE NETWORK

Vaccination	Cows		Replacement Heifers		Bulls		Suckling Calves		Weaned Calves	
	West	East	West	West	East	East	West	East	West	East
BVDV Type 1 or 2 (for respiratory and gastrointestinal issues)	92%	93%	95%	85%	73%	80%	80%	73%	54%	65%
IBR, BRSV, PI3 (for respiratory diseases)	92%	93%	95%	85%	73%	80%	91%	93%	54%	68%
IN IBR, BRSV, PI3 (for respiratory diseases)	-	-	-	-	-	-	31%	38%	-	-
M. haemolytica +/− *P. multocida* (for pneumonia & respiratory diseases)	1%	10%	5%	13%	9%	8%	67%	30%	35%	18%
H. somni (for respiratory diseases)	22%	10%	26%	13%	20%	8%	52%	13%	18%	13%
Campylobacter and/or *Leptospira app.* (for reproductive diseases)	33%	48%	36%	43%	27%	35%	-	-	-	-
Clostridia spp.	68%	33%	82%	33%	57%	33%	95%	70%	33%	15%
Calf Scours	55%	48%	59%	43%	-	-	-	-	-	-
Footrot	2%	0	-	-	44%	0	-	-	-	-

Source: Lazurko, et al. (2023).

Insights for Knowledge Mobilization

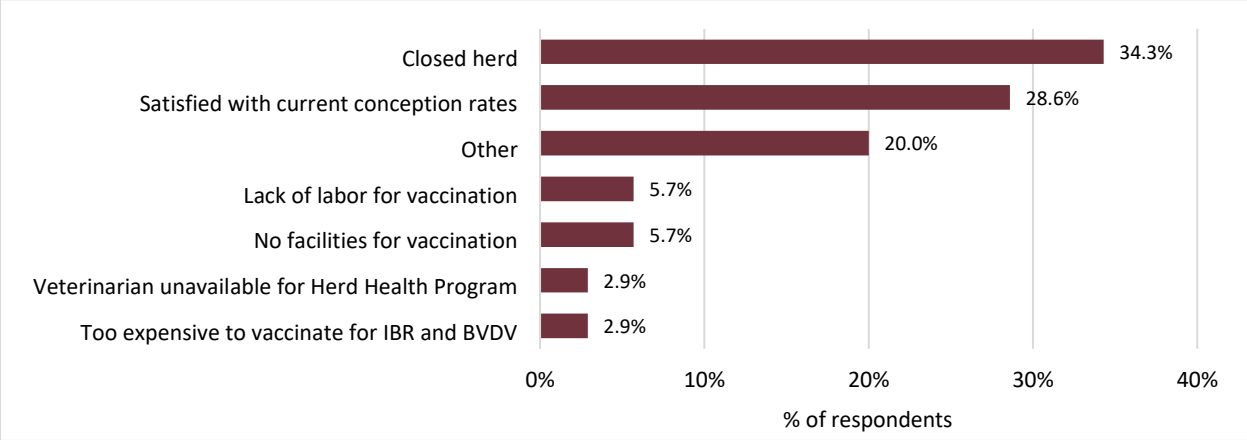
Perceived Status: Close to peak adoption. Recommend supporting existing adoption with regular communications.

Vaccination rates across Canada have been stable. In Western Canada, overall vaccination rates have trended from 95% in the WCCCS II (University of Saskatchewan, 2018) to 93.0% in the 2022-23 CCCS (CCCS, 2024), with a stable trend for vaccinating cows for reproductive diseases, a decreasing trend for vaccinating cows for scours, a stable trend for vaccinating calves for clostridial, and a decreasing trend for vaccinating calves for respiratory diseases. In Eastern Canada for overall vaccination has trended from 70-84% in 2016-2017 studies (Maritime Beef Council, 2018; Lamothe and North Haven Solutions, 2018; University of Guelph, 2018) to 88.4% in the 2022-23 CCCS (CCCS, 2024). The vaccination trends of cows for reproductive diseases have increased and have remained stable for scours. Trends for calves' vaccination rates for clostridial and respiratory diseases are unknown.

Barriers: The 2022-23 CCCS revealed that 34.3% and 35.5% of respondents were not vaccinating cows for reproductive and respiratory disease, respectively, citing the perception of having a closed herd (CCCS, 2024, Figure 15). This remains the top reason for not vaccinating; a finding consistent with the WCCCS II (University of Saskatchewan, 2018). The second leading reason for not vaccinating cows for reproductive diseases was producers' satisfaction with their conception rates, leading them to perceive no need for vaccination (28.6%). Similarly, the reason for not vaccinating calves for BRD was also the perception of a closed herd (35.5%), followed by the perception of calves being healthy and not needing to be vaccinated (29%, Figure 16). For respiratory disease, a close second reason for not vaccinating was selling calves right after weaning (28.1%).

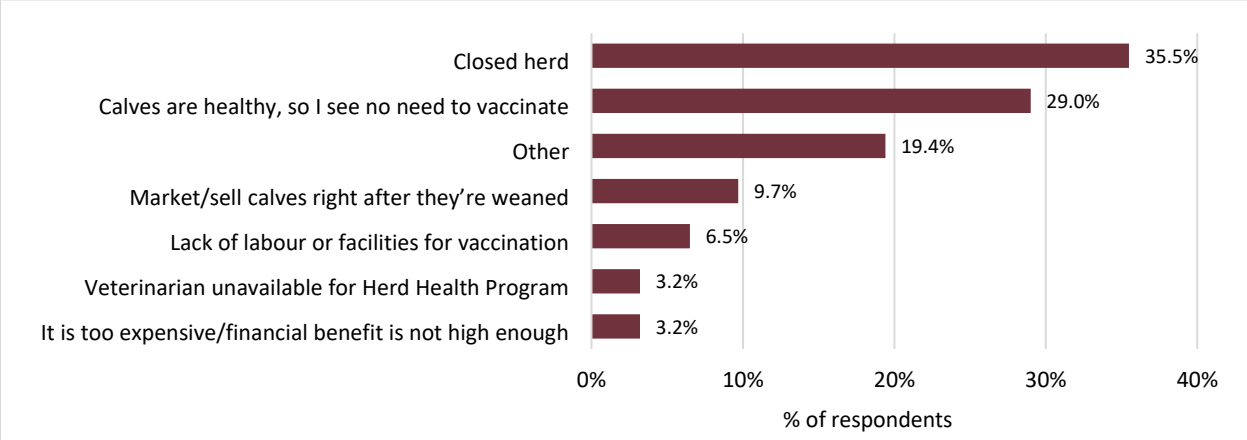
The 2022-23 CCCS reported selling calves right after weaning as a reason for not being vaccinated for BRD at 9.7% (CCCS, 2024, Figure 16), lower than the 28.1% reported in the WCCCS II (University of Saskatchewan, 2018). Producers surveyed in 2020 for the C3SN initiative illustrated that weaned calves were not vaccinated to the same rate as suckling calves (Lazurko, et al., 2023).

FIGURE 15. TOP REASONS FOR NOT VACCINATING COWS AGAINST REPRODUCTIVE DISEASE



Source: 2022-23 CCCS (CCCS, 2024).

FIGURE 16. TOP REASONS FOR NOT VACCINATING CALVES AGAINST BOVINE RESPIRATORY DISEASE



Source: 2022-23 CCCS (CCCS, 2024).

Resources: BCRC has a *Vaccination of the Beef Herd* (BCRC, 2025f) topic page, *Veterinarian-Client-Patient Relations (VCPR)* topic page (BCRC, 2024o), and a *Think you have a Closed herd?* page (BCRC, 2020). BCRC also has available a *Cost-Benefit of BVD Vaccinations* calculator (BCRC, n.d.-b), and Cost-Benefit of Feeding BRD Vaccinated Calves calculator (BCRC, n.d.-c).

Opportunity: Continue to communicate that a truly closed herd is a rarity. A close herd means there's absolutely no (including fenceline) contact with outside livestock or wildlife, and even areas without cattle have limited visitor access. Furthermore, new animals like breeding bulls from other herds would not have contact with the operation's herd, and any animal that leaves the property never returns (BCRC, 2020). Because of practical challenges like fence-line contact with neighboring animals and the need to introduce new genetics through purchased bulls, genuinely closed herds are exceedingly uncommon.

All producers should strive for 100% vaccination against diseases relevant to their region. Producers should consult with their veterinarian on a herd health protocol that works for their region and operation's management (Wilhelm et al., 2023). Vaccination must remain a priority for knowledge mobilization as new information and prevention techniques become available. Continuing to increase information about intra-nasal, oral, and remote delivery vaccines for producers and guidance on storing, handling and administering vaccines will help encourage adoption and effectiveness.

Vaccinating bulls is less common than vaccinating cows, as reported in the WCCCS II (University of Saskatchewan, 2018). The 2020 results from the C3SN also reported lower rates of vaccination for bulls compared to cows (Lazurko, et al., 2023). These findings suggests that more promotion could be focused on bull vaccination as a specific recommended practice.

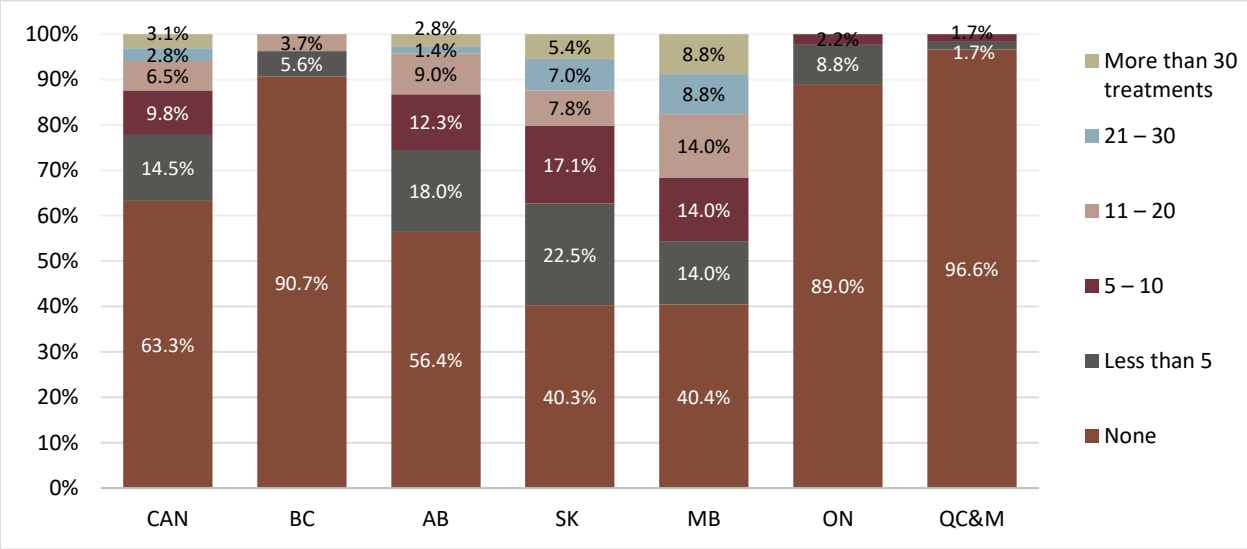
According to Maier et al. (2022), scours vaccination can be a helpful component in preventing *neonatal calf diarrhea* (NCD), but it should not be relied upon as the sole strategy. Successful prevention of NCD depends heavily on cleanliness of calf housing, effective colostrum intake (see the section on *Early Life Interventions*), and broader herd health measures. While vaccinating dams or calves can support other interventions, vaccine efficacy may be compromised by mismatches between vaccine strains and the specific outbreak pathogens. Therefore, accurate diagnostics and careful vaccine selection are critical for effective implementation (Maier et al., 2022).

REMOTE DRUG DELIVERY DEVICES

Remote drug delivery devices (RDDD) represent a tool for producers to treat sick cattle in remote locations or without access to handling facilities (BCRC, 2023d). It also allows producers to administer medication in a less stressful environment.

According to the 2022-23 CCCS, 36.7% of respondents nationally used a RDDD for treatment, with 14.5% utilizing it fewer than five times per year (CCCS, 2024). The Prairies had the highest adoption rate of RDDD compared to the rest of Canada. Specifically, in Saskatchewan 17.1% of producers used RDDD 5-10 times a year and 7.8% used it 21-30 times a year, while 14% of Manitoba used RDDD 5-10 times a year and 8.8% used it 21-30 times a year. These two provinces had the highest adoption rates (CCCS, 2024, Figure 17). These devices are presumably used in large, remote pastures where handling facilities and transportation options may be limited.

FIGURE 17. NUMBER OF TREATMENTS USING REMOTE DRUG DELIVERY DEVICES, BY PROVINCE



Source: 2022-23 CCCS (CCCS, 2024).

Most of the time (94.4%), RDD was used for foot rot, septic arthritis and/or lameness (CCCS, 2024). These devices were less commonly used for pink eye (49.1%) and BRD (41.7%) (CCCS, 2024). Within the survey, using darts was the second preferred method of treatment, following walking animals to a nearby barn or facility for treatment (CCCS, 2024).

There is a concern about the use of RDDDs regarding carcass quality, including bruising and lesions from RDD. The previous *National Beef Quality Audit* (2018) illustrated that there was an increase in carcass lesions in non-fed cattle from 2010-11 to 2016-17. The increased adoption of RDD may be one reason for the increase in the total number of lesions. However, RDDD serve as a tool under the right circumstances.

Injection site lesions cause industry-wide losses due to adverse effects on carcass quality (National Beef Quality Audit, 2018). Due to the absence of a National Beef Quality Audit update since 2018, current values for lesion occurrence in fed and non-fed cattle carcasses are unavailable.

Insights for Knowledge Mobilization

Perceived Status: Niche Practice. Recommend that knowledge mobilization resources be available for producers to learn about these practices, and for adoption be monitored. But recognize that the practice is only suitable and of interest to a subset of producers.

In Western Canada, RDD is used once or more per year by 45.3% of producers, while in Eastern Canada this proportion is 7.7% (CCCS, 2024). Nationally, over one-third of respondents have used a RDDD, indicating that communications promoting beneficial treatment practices could be impactful (CCCS, 2024).

Barriers: The lack of handling facilities in remote pastures made the adoption of RDDD more attractive to a subset of producers who have the skills and knowledge of effective and safe use.

Resources: The BCRC has a *Remote Drug Delivery* (BCRC, n.d.-j) topic page, as well as a flier and printable brochure for veterinarian offices to distribute.

Opportunities: Producers must ensure that they aim for the animal's safe injection site and only use needles that are not bent, dull or damaged (BCRC, 2023d). Some veterinarians also caution that there is no guarantee that the product from a RDD will get into the animal's system (Brooks, 2023). However, if administered at approximately a 90-degree angle within the neck's safe injection site, the medication will likely be delivered safely. (BCRC, 2023c). There is an opportunity for further knowledge mobilization on the importance of safe and accurate use of RDDD to prevent bruising and lesions.

PARASITE MANAGEMENT

Parasites, both internal and external, can negatively impact animal welfare, affect production, and cause disease in Canadian beef cattle. Effective parasite control is crucial for maintaining health, welfare, and production, with different parasites requiring specific control measures. To effectively control parasites in beef cattle, producers first need to know which parasites they are dealing with (BCRC, 2024f).

Most Canadian producers (87.1%) use external and internal parasite control (CCCS, 2024, Table 36). British Columbia reported the highest percentage at 94.4% (CCCS, 2024). Pour-on products are highly popular and commonly used to target both internal and external parasites. Direct comparison between surveys is not exact, as the 2022-23 CCCS's question on parasite control *included both external and internal parasite control* as a response option (CCCS, 2024). Compared to the 2017 survey responses, external and internal parasite control has remained relatively stable (Table 36).

Parasite control is reported to be commonly applied to cattle in the fall (36.1%), winter (35.8%) and before spring turnout (24.7%, CCCS, 2024). Summer is the least common season of application (3.4%), likely due to cattle being turned out for grazing (CCCS, 2024).

TABLE 36. PARASITE CONTROL USE BY PROVINCE

Region	External parasite control		Internal parasite control		External/ internal parasite control	Trend [e]	
	Past	Current [e]	Past	Current [e]	Current [e]		
Canada		36.6%		26.6%	87.1%	?	
MT	84% [a]	29.3%	70% [a]	17.2%	87.9%	External	↓
						Internal	↓
QC	-		93% [c]			External	?
						Internal	↓
ON	26% [b]	37.4%	67-86% [bc]	27.5%	84.6%	External	?
						Internal	↓
MB	91% [d]	44.6%	74% [e]	32.1%	85.7%	External	↓
						Internal	↓
SK		36.4%		33.3%	90.7%	External	↓
						Internal	↓
AB		41.9%		25.2%	88.6%	External	↓
						Internal	↓
BC		14.8%		18.5%	94.4%	External	↓
						Internal	↓

Source: [a] 2017 ACCS (Maritime Beef Council, 2018); [b] 2017 OCCS (University of Guelph, 2018); [c] Northern Ontario and Northern Québec Study, cows only (Lamothe and North Haven Solutions, 2018); [d] 2016-17 WCCCS II (University of Saskatchewan, 2018); [s] 2022-23 CCCS (CCCS, 2024).

[e] Varying question types across surveys may impact trends.

Insights for Knowledge Mobilization

Perceived Status: Close to peak adoption. Recommend supporting existing adoption with regular communications.

In the 2022-23 CCCS survey, there were three options for producers to choose from regarding parasite control: internal, external, and external/internal (CCCS, 2024). In historical surveys conducted in 2017, producers reported using either external or internal parasite control, which limits direct comparability with more recent surveys. This distinction explains the observed significant decrease in overall parasite control adoption. (Maritime Beef Council, 2018; University of Guelph, 2018; University of Saskatchewan, 2018).

Across Canada, a stable to downward trend for the adoption of parasite control has been observed. In Western Canada, the use of external parasite control is trending from 91%, as reported in the WCCCS II (University of Saskatchewan, 2018), to 36.8% as reported in the 2022-23 CCCS (CCCS, 2024), internal parasite control ranges from 74% as reported in the WCCCS II (University of Saskatchewan, 2018) to 27.0% as reported in the CCCS (CCCS, 2024), and current external/internal parasite control adoption has been calculated at 85.6% as reported in the CCCS (CCCS, 2024).

In Eastern Canada, the reported use of external parasite control shows a trend from 26% in the 2017 OCCS (University of Guelph, 2018) and 84% in the 2017 ACCS (Maritime Beef Council, 2018) to 32.9% in the

2022-23 CCCS (CCCS, 2024). Similarly, internal parasite control was reported at 70% in the 2017 ACCS (Maritime Beef Council, 2018), 67% in the 2017 OCCS (University of Guelph, 2018), 86% in Ontario, and 93% in Québec (Lamothe and North Haven Solutions, 2018). The reported use of this practice dropped to 23.2% in the 2022-23 CCCS (CCCS, 2024), which also indicates a current adoption rate of 83.9% for combined external/internal parasite control.

Barriers: Reasons for not using parasite control included concerns about resistance (19.4%), organic production (19.4%), cost or perceived financial benefit (17.0%), and worries regarding product effectiveness (11.1%). Additionally, 33% of respondents mentioned *other* reasons, predominantly concerning soil microbe health (CCCS, 2024).

Resources: BCRC has topic pages for both *External Parasites* (BCRC, 2024b) and *Internal Parasites* (BCRC, 2024f), as well as webinars on the *Ins and Outs of Parasite Management* (BCRC, 2025c).

Opportunity: Just over half (52.4%) of respondents who practice parasite control tend to use the same product consistently. However, employing alternative parasiticides with diverse modes of action and active ingredients is a more desirable practice, as it can slow the development of resistance (Prichard and Geary, 2019). This presents a valuable opportunity for broader adoption (BCRC 2024e), as 19.4% who don't use it are concerned about resistance. Parasite control products are typically cost-effective and easy to apply, factors that should further encourage their adoption. While overall adoption is currently high, knowledge mobilization efforts should focus on preventing product resistance and addressing existing misperceptions.

VETERINARY COMMUNICATION

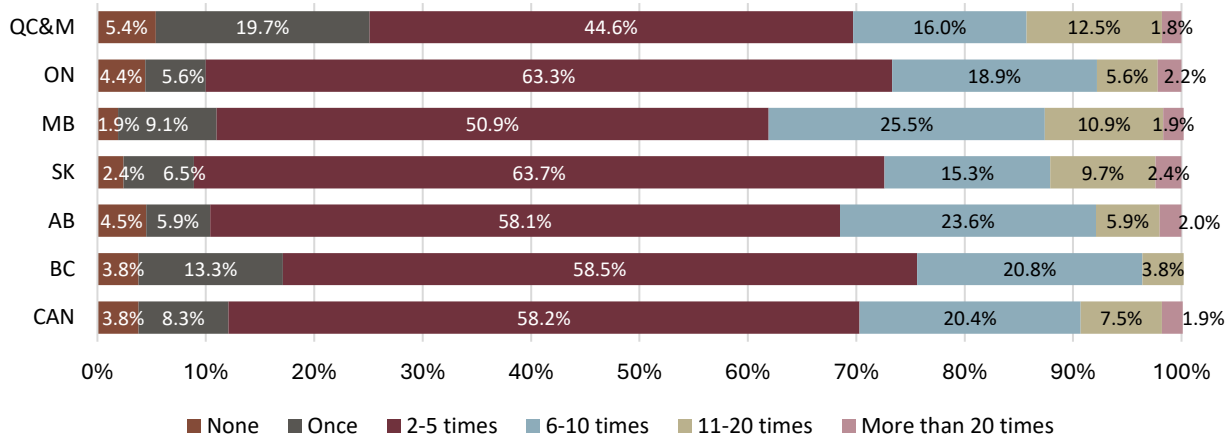
The National Farm Animal Care Council (2013) requires that all livestock producers have an ongoing veterinarian-client-patient relationship (VCPR) with a licensed practicing veterinarian. Federal legislation requires a veterinary prescription before a veterinarian can dispense medically important antimicrobials for livestock. Communication between producers and veterinarians varies by issue and topic.

The CCCS reported that most respondents nationally interact with a veterinarian two to five times annually to purchase antibiotics, vaccines, or supplies (58.2%), with less than half interacting with a veterinarian for emergency cases (37.3%, CCCS, 2024, Figure 18). Single annual visits most commonly coincide with pregnancy checking (49.9%) and bull soundness evaluations (53.1%, CCCS, 2024). From all respondents, 34.8% reported consulting veterinarians for herd health programs once a year, 37.2% reported two to five times per year, while 24.1% choose not to use the veterinarians for herd health consultation.

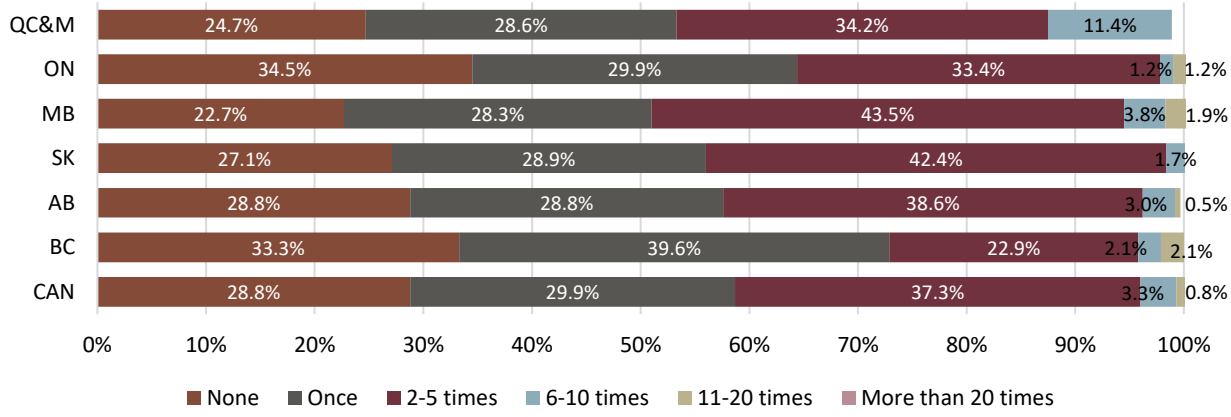
Interest in learning *beneficial management practices* (BMPs) and scientific information from veterinarians varied among respondents. For BMPs, 27.9% of producers consulted a veterinarian once a year, 31% consulted two to five times, and 36% did not seek advice from veterinarians at all (CCCS, 2024). Regarding scientific information, veterinary consultation rates are lower: 26.1% consulted once a year, 21.6% two to five times, and 50.7% did not seek veterinary advice (CCCS, 2024). In place of veterinary consultation, producers may utilize industry communications, government extension services, and other sources such as agricultural newsletters, personal communications, and online resources.

FIGURE 18. FREQUENCY OF VETERINARIAN COMMUNICATION FOR VARIOUS REASONS IN THE LAST 12 MONTHS

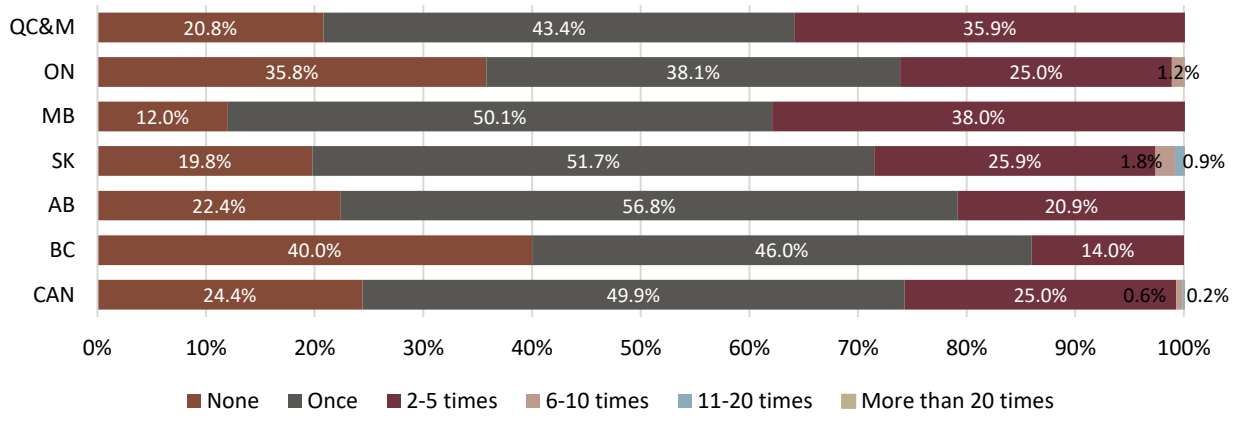
a) PURCHASE ANTIBIOTICS, VACCINES OR OTHER SUPPLIES



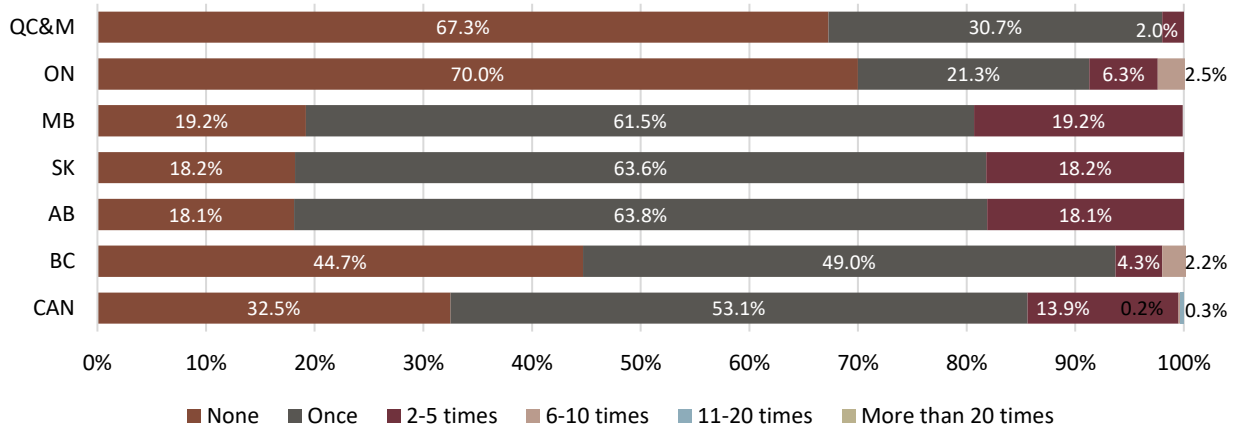
b) EMERGENCY ANIMAL HEALTH OR CALVING PROBLEM



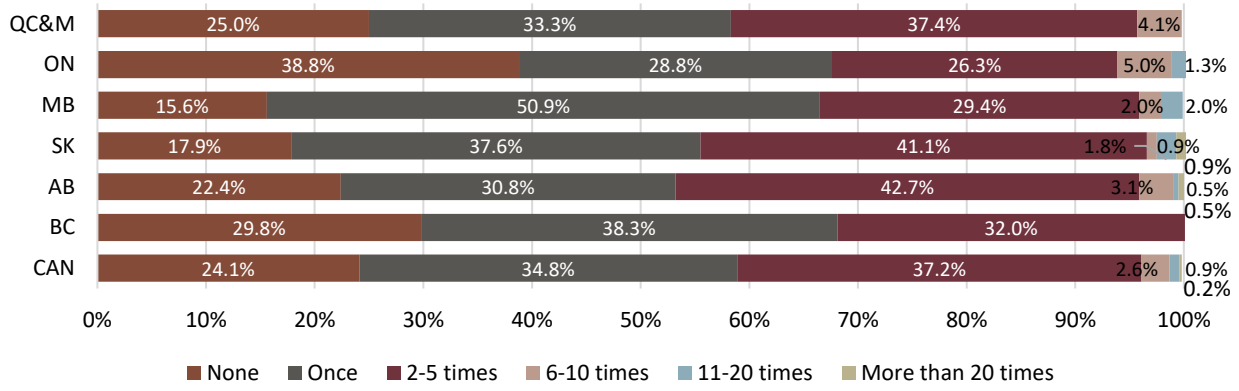
c) PREGNANCY CHECKING



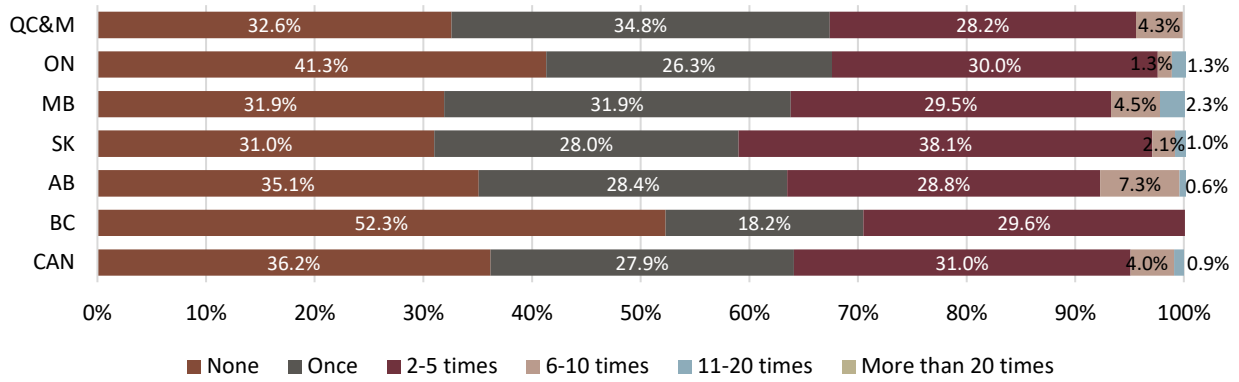
d) BULL SOUNDNESS EVALUATION



e) CONSULTATION/ADVICE ON HERD HEALTH PROGRAM



f) QUESTIONS/LEARNING ABOUT BEST MANAGEMENT PRACTICES



Source: 2022-23 CCCS (CCCS, 2024).

Of the producers participating in the C3SN survey, 71% used veterinary advice for a specific animal to determine if and when antimicrobial treatment was required and to choose a specific product, and 66% used veterinarian communication to determine what dosage to use (Fossen et al., 2023a). Written protocols developed by a veterinarian were less commonly used to determine if treatment is required (16%), to choose an antimicrobial (21%), or to determine dosage (19%, Fossen et al., 2023a). For consultations with a veterinarian, the proportion who rely on a written protocol to determine if a treatment is required decreased further to 6.2%, and to 8.9% for choosing an antimicrobial. When initial treatments for respiratory and gastrointestinal diseases failed, consulting a veterinarian was the producers' first option (74% and 68%, respectively). For lameness treatment failure, however, the initial course of action was trying a different antimicrobial (53%), followed by consulting with a veterinarian (49%). One reason producers might not seek veterinary advice for lameness is if cattle are out on pasture for grazing, leading the producer to treat the animal there (Erickson et al., 2024; Fossen, 2023b). However, it's crucial to remember that antimicrobials aren't recommended for all types of lameness (e.g., sand cracks). If lameness doesn't improve with antimicrobial treatment, contacting a veterinarian should be the immediate next step to address the treatment failure (Erickson et al., 2024).

Insights for Knowledge Mobilization

Perceived Status: Veterinarian Communication is a new benchmark with the 2022-23 CCCS. Improving, but low adoption. Recommended strategy is to increase depth of adoption.

The CCCS reported that most respondents at a national level interact with a veterinarian two to five times annually to purchase antibiotics, vaccines, or supplies (58.2%), and to seek help in emergency cases (37.3%, CCCS, 2024). In Western Canada, 67.8% seek veterinary advice for a herd health program (CCCS, 2024). In Eastern Canada, 54.2% seek veterinary advice for a herd health program (CCCS, 2024).

Resources: BCRC has a *Veterinarian-Client-Patient Relations (VCPR)* (BCRC, 2024o) topic page

Barriers: Regions with low veterinary accessibility for consulting on herd health create a barrier for frequent and quick consultations when needed.

Opportunity: Encourage producers to consult a veterinarian for the initial treatment of ailments, rather than waiting until primary treatments fail. This approach can help avoid unnecessary antimicrobial use and inaccurate diagnoses. Herd health consultation isn't widely adopted in Ontario, with only 38.8% participation. This represents an opportunity for beef producers and veterinarians in Ontario to increase

the frequency of their herd health consultations. Previous research illustrated that Ontario veterinarians only spent 1.9% of their practice time delivering health information to beef cow-calf operations (Rogers et al., 1985).

After the 2018 federal regulations mandated veterinary prescriptions for all medically important antimicrobials, Wilhelm et al. (2025) found that small-sized operations posed the biggest challenge for veterinary clinics. This was due to these operations' greater difficulty establishing and maintaining a VCPR. The study suggested several tools to support beef cow-calf veterinarians in antimicrobial prescribing.

FEED AND NUTRITION

Feed and nutrition are important for animal health, performance, and profitability. Feed quality, regardless of whether it is homegrown or purchased, can be impacted by disease, weather conditions (i.e., drought, excess moisture) or improper storage. Visual assessment of feedstuffs is not accurate enough to access quality and may lead to cows being underfed and losing body condition. Additionally, small nutritional differences in the quality of feed, such as the trace mineral content can have a substantial impact on productivity. Limited water options are another factor affecting feed and nutrition in remote operations which can lead to reduced water quality and intake.

Potential practices for feed and nutrition include:

- ***Feed Testing*.** Regularly analyzing feed quality is crucial to prevent nutrient deficiencies or toxicities, as these issues may not be visible through simply looking at the feed or the animals' condition.
- ***Ration Balancing*.** Providing an optimal mix of protein, energy, vitamins, and minerals based on the cow's production stage (National Academies of Sciences, Engineering, and Medicine, 2016).
- ***Water testing*.** Water quality and intake affects cattle growth, health and performance. High levels of sulfates, algae, and bacteria in water supply can lead to dehydration, reduced performance, and even death.
- ***Mineral Supplementation*.** Providing targeted mineral supplementation, especially in low-quality forage situations.

FEED TESTING AND RATION BALANCING

Feed testing helps producers identify potential nutrient imbalances based on the results. Survey results suggest that feed testing has increased across Canada, with nearly twice as many producers in the Maritimes and Ontario feed testing compared to 2017. In Western Canada, adoption rates are nearly consistently over 70%, with the exception of British Columbia (Table 37).

The 2017 surveys reported a lower adoption rate for feed testing: 62% in Western Canada (University of Saskatchewan, 2018) and a range of 26% to 43% in Eastern Canada (Maritime Beef Council, 2018; Lamothe and North Haven Solutions, 2018; University of Guelph, 2018). Testing rates were highest in Alberta (73.4%) and Manitoba (68.5%, CCCS, 2024, Table 37). Other survey estimates place the proportion of producers who feed test as high as 84% (Lazurko et al., 2024), though this particular sample may be biased in favour of feed testing adoption.

Feed testing has been found to be highly correlated with herd size, with 40% of producers managing herds of less than 100 cows testing their feed, compared to 64% with herds between 100 and 249 cows, and 85% with herds over 250 cows.

The proportion of producers who feed tested and balanced rations given to cattle was high in 2019 for Western Canada at 95%. In Alberta, ration balancing dropped to 70.6% in 2023, though this is still significantly higher than the 25.7% of producers who balanced rations in 1997-98 (Alberta Agriculture and Rural Development, 1998) (Table 38).

The proportion of producers who developed their own rations in Western Canada appeared to be increasing in every province except Alberta, though the 2019 Adoption Rates report (BCRC, 2019a) did not provide a distribution by province (Table 38).

TABLE 37. PROPORTION OF OPERATIONS THAT TEST FEED FOR QUALITY

Region	2019 Adoption Rates Report (BCRC, 2019a)	2022-23 Canadian Cow-Calf Survey (CCCS, 2024) [f]	Trend
Canada	-	69.3%	?
MT	26% [a]	50.0%	↑
QC	43% [b]		↑
ON	16% [b]	53.8%	↑
	33.7% [c]		↑
MB	47-62% [d,e]	78.9%	↑
SK		71.3%	↑
AB		73.4-77.7% [g]	↑
BC		68.5%	↑

Sources: [a] 2017 ACCS (Maritime Beef Council, 2018); [b] 2015-16 Northern Ontario and Northern Québec Study (Lamothe and North Haven Solutions, 2018); [c] 2017 OCCS (University of Guelph, 2018); [d] 2013-14 WCCCS (Western Beef Development Centre, 2015); [e] 2016-17 WCCCS II (University of Saskatchewan, 2018); [f] 2022-23 CCCS (CCCS, 2024); [g] AALL Survey (AALL, 2024).

TABLE 38. PROPORTION OF OPERATIONS THAT BALANCE RATIONS IF THEY FEED TEST

Region	2019 Adoption Rates Report (BCRC, 2019a)	2022-23 Canadian Cow-Calf Survey (CCCS, 2024) [e]	Trend
MT	72% balance rations [a]	17.2% balance with nutritionist, 6.9% balance with extension Specialist, 51.7% develop own rations Total: 75.8%	↓
QC	26% balance rations [b]		↑
ON	15% balance rations (Northern Ontario) [b]	53.1% balance with nutritionist, 2.0% balance with extension Specialist, 30.6% develop own rations Total: 85.7%	↑
	Of the 33.7% who feed tested, 79.31% used the results to balance rations, 48.28% balance ratios with a nutritionist, 31.03% balance rations themselves [c]		↑
MB	38.1% balance with nutritionist, 12.5% balance with extension specialist, 44.4% develop own rations using test results [d] Total: 95%	26.7% balance with nutritionist, 13.3% balance with extension Specialist, 57.8% develop own rations Total: 97.8%	↔
SK		29.3% balance with nutritionist, 8.7% balance with extension Specialist, 55.4% develop own rations Total: 93.4%	↔
AB		35.5% balance with nutritionist, 1.9% balance with extension Specialist, 33.2% develop own rations Total: 70.6%	↓
BC		10.8% balance with nutritionist, 2.7% balance with extension Specialist, 70.3% develop own rations Total: 83.8%	↓*

Sources: [a] 2017 ACCS (Maritime Beef Council, 2018); [b] Northern Ontario and Northern Québec Study (Lamothe and North Haven Solutions, 2018); [c] 2017 OCCS (University of Guelph, 2018); [d] 2016-17 WCCCS II (University of Saskatchewan, 2018); [e] 2022-23 CCCS (CCCS, 2024).

**Increasing trend of producers in BC in balancing their own rations.*

A survey of 324 Western Canadian cow-calf producers found that only 59% (n=195) used feed testing at least once in the past three years (BCRC, 2024n). Among producers not adopting feed testing, the majority (66%) stated they do not test because their animals appear healthy, negating the perceived need to do so (BCRC, 2024n). Respondents who reported feed testing are using it to meet their production goals (27%), to determine the need for commercial supplements (23%), and to develop least-cost rations (20%, BCRC, 2024n). Additionally, producers who test their feed tend to conduct other related tests more frequently, such as for water quality and toxins. The authors found that producers adopting feed testing often work with external consultants to help them make the most of feed test results, including ration balancing (BCRC, 2024n). These data shows that there are multiple complementary factors that help producers utilize lab results.

Insights for Knowledge Mobilization

Perceived Status: Improving, but low adoption. Recommended strategy is to increase depth of adoption.

Western Canada exhibits a steady trend with producers who feed test occasionally or more with reported adoption rates ranging from 60% as reported in the 2016-17 WCCCS II (University of Saskatchewan, 2018) to 73.6% as reported in the 2022-23 CCCS (CCCS, 2024). In Eastern Canada, there is an increasing positive trend, with producers who feed test occasionally or more trending from 16-43% in 2015-17 (Maritime Beef Council, 2018; Lamothe and North Haven Solutions, 2018; University of Guelph, 2018) to 50.3% 2022-23 (CCCS, 2024).

Barriers: Barriers to feed testing are well-documented. When asked for reasons for not feed testing, the most common responses from the 2022-23 CCCS (CCCS, 2024) were: cattle seem healthy so no need to test (45.1%), lack of confidence in making or implementing plans based on the results of feed testing (15.9%), too expensive to test (12.1%), and being unsure about how to collect and send in samples (9.9%).

According to work led by AAFC Lethbridge (BCRC, 2024n), 66% of the 324 Western Canadian producers surveyed do not test their feed. Of these, the majority cited their animals' healthy appearance as the reason, while 15% were unsure about the feed testing process.

Resources: Multiple topic pages are available including *Feed quality, testing and analysis for beef cattle* (BCRC, 2024d), *Mycotoxins* (BCRC, 2023f), *Nutrition in beef cattle* (BCRC, 2024g). Producers can also purchase *CowBytes* ration balancing software to develop rations themselves. The Government of Saskatchewan has a resource list of feed and water test laboratories (Government of Saskatchewan, n.d.-c) and a nutritional cattle guide (Government of Saskatchewan, n.d.-b).

Opportunities: Future extension efforts could target producers who lack confidence in feed testing or are unsure how to collect samples.

Communications should target Eastern Canada, as Lazurko et al. (2024) found that Western Canadian herds were nearly five times as likely to test feed and use a nutritionist for ration balancing than their Eastern Canadian counterparts. While the difference between regions found by CCCS (CCCS, 2024) was not as striking, there is a slightly higher proportion of producers in Eastern Canada who stated they did not feed test because of lack of confidence and/or being unsure about collecting and sending in samples.

The AAFC Lethbridge work (BCRC, 2024n) reported that 27% of producers who practiced feed testing used it to meet their production goals, while 23% used tests to determine the need for commercial supplements, and 20% to develop least cost rations.

A small proportion of the producers who practice feed testing are developing feed rations with the support of a nutritionist or extension specialist. This could indicate that producers are confident making decisions based on their level of knowledge on feedstuffs. However, given that nutritional deficiencies were also relatively high during the same period (see *Mineral Supplementation* section), there may be a benefit for producers to work with feed experts.

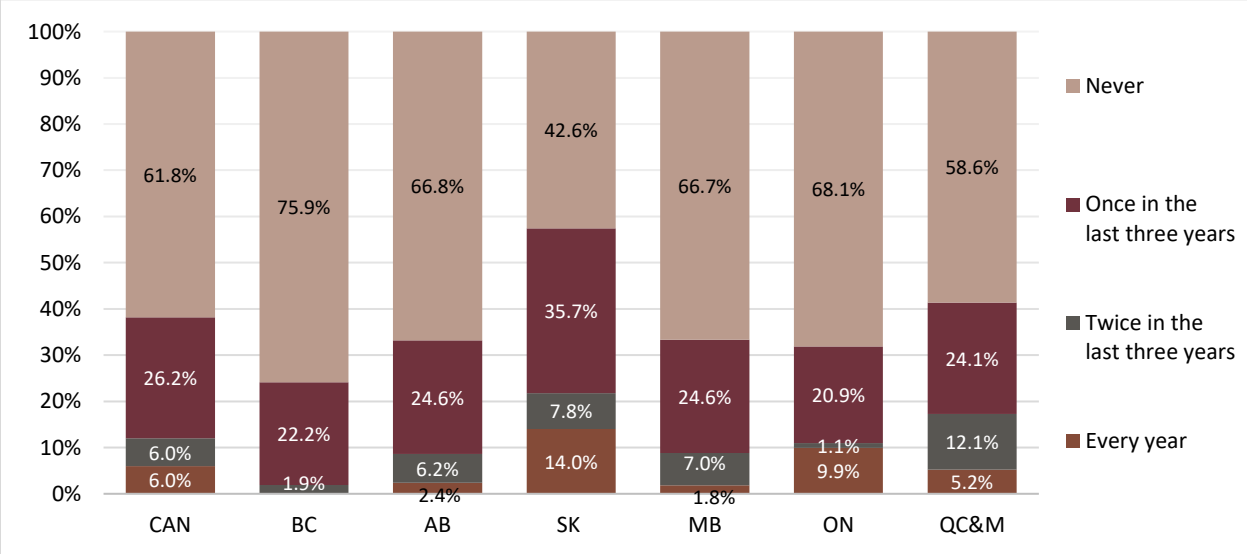
Extension efforts can enhance both the adoption and the effective use of feed testing by addressing these barriers and tailoring solutions. Doing so would ultimately support better herd health, productivity, and economic returns.

WATER TESTING

Water quality and intake affects cattle growth, health and performance. High levels of sulfates can lead to reduce trace mineral metabolism, diarrhea, and death. Additionally, producers should monitor algae, salinity, and bacteria within their water source. Since water source quality can change over time, regular water testing is recommended to ensure it remains adequate throughout the production year (BCRC, 2024m).

According to the 2017 WCCCS II, 41% of producers in Western Canada conducted water quality tests for their livestock at least once every three years (University of Saskatchewan, 2018). Similarly, in Northern Ontario, 41% of producers reported water testing in the last 5 years, while only 17% of Québec producers conducted water testing on their primary water source (Lamothe and North Haven Solutions, 2018). Reported adoption rates for water testing decreased in the 2022-23 CCCS with 6.0% of respondents testing livestock drinking water annually, 6.0% testing twice in *the last three years*, 26.2% testing once in the last three years, and 61.8% not water testing at all (CCCS, 2024). Saskatchewan had the largest number of producers who tested their water at least once in the last 3 years (57.5%) (Figure 19). Among producers who tested water at least once in the last three years, 62.4% did so in the summer, 21% in the winter, and 16.6% in both seasons.

FIGURE 19. RESPONDENTS ANSWERED FREQUENCY OF WATER TESTING



Source: 2022-23 CCCS (CCCS, 2024).

Insights for Knowledge Mobilization

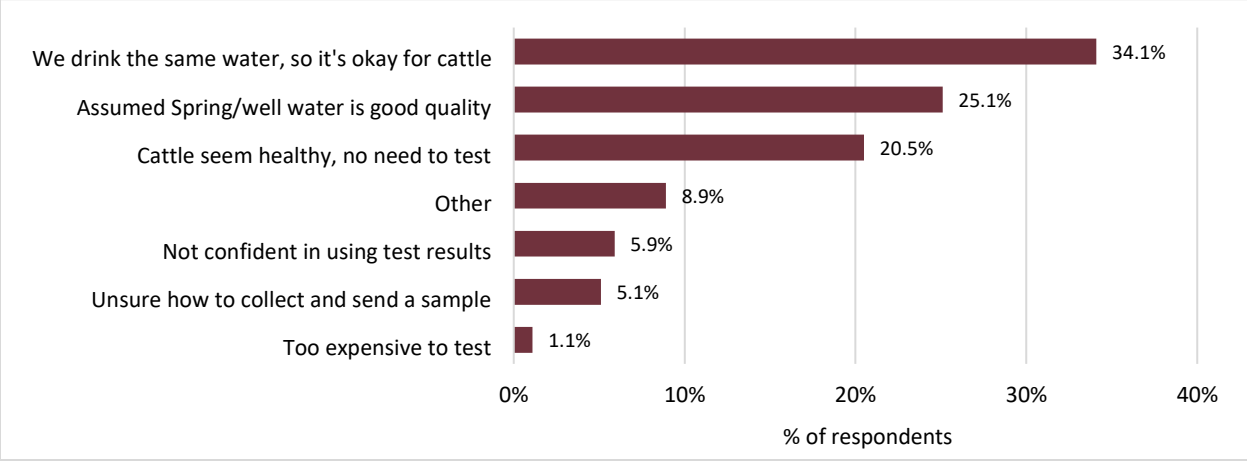
Perceived Status: Below target. Recommend targeting with knowledge mobilization materials.

Western Canada exhibits a decreasing negative trend for water testing, with producers testing *at least every 3 years* trending from 41% as reported in the WCCCS II (University of Saskatchewan, 2018) to 39.0% reported in the CCCS (2024).

Eastern Canada has experienced a stable trend for water testing. Survey results suggested 41% producers in Ontario and 17% in Québec water tested *in the last 5 years* (Lamothe and North Haven Solutions, 2018). A later survey reported the adoption rate for water testing *at least every 3* years being 35.6% (CCCS, 2024).

Barriers: Producers gave various reasons for not testing water. The most common reasons included the belief that since the household drinks the same water, it's suitable for cattle (34.1%), an assumption of good well water quality (25.1%), and the observation that cattle seem healthy (20.5%, CCCS, 2024). *Other* reasons comprised 8.9%, followed by a lack of confidence in using test results (5.9%), uncertainty about sample collection and testing (5.1%), and cost (1.1%, CCCS, 2024, Figure 20). The *other* reasons included relying on municipal water, consistently changing water sources like rivers and creeks, and only testing water *every five years or longer* (CCCS, 2024).

FIGURE 20. RESPONDENTS' REASONS FOR NOT WATER TESTING



Source: 2022-23 CCCS (CCCS, 2024).

Access to water testing labs is limited in some provinces. Awareness gaps also exist, with limited understanding of water quality issues, lack of access to information on beneficial practices, and inadequate awareness of available resources. Operational challenges include remote water source locations and difficulties in maintaining consistent water quality during extreme weather events.

Resources: The BCRC has a *Water Systems for Beef Cattle* (BCRC, 2024m) topic page and a Water Systems Calculator (BCRC, n.d.-l). However, both these resources focus on off-site watering systems and not testing for water quality. Additional water quality and management resources are in development by the BCRC in collaboration with a multi-organization working group.

Opportunities: Regardless of the water source, there is a significant opportunity to educate producers across Canada to the importance of water quality testing. By empowering producers to establish their own on-farm water quality benchmarks, they can track changes over time, identify factors that impact water quality, and make informed decisions. Additionally, raising awareness about the potential

cumulative effects of harmful substances like nitrates, sulfates, and other toxins in both water and feed is crucial for ensuring optimal cattle health.

Off-site water systems offer an indirect benefit for water quality by mitigating fecal contamination, which otherwise reduces water palatability and consumption in cattle with direct access. Supplying clean pumped water can improve herd health and increase weight gain and backfat. Managing livestock access to surface water is an effective way to maintain clean water, support animal health and growth, and support overall animal well-being (Lardner et al., 2005; BCRC, 2024m).

MINERAL SUPPLEMENTATION

Trace mineral deficiencies can lead to production declines, animal health events, and reproductive issues (BCRC, 2024f). Trace minerals such as Selenium (Se), Copper (Cu), Zinc (Zn), Manganese (Mn), Cobalt (Co), and Iodine (I) are ingested by cattle through forages and supplemental sources. The concentration of these minerals in forages depends on many factors, such as forage species, season, soil characteristics, and the presence of mineral antagonists, all of which impact the availability of ingested minerals. Forages are commonly deficient in trace minerals, meaning that cattle who rely solely on forages for feed are more prone to mineral deficiencies compared to cattle fed a *total mixed ration* (TMR) or provided with supplements (Hersom & Thrift, 2018; Arthington & Ranches, 2021).

Waldner et al. (2023) observed specific trace mineral deficiencies in beef cows across Canada, noting that copper deficiency was lower in 2019 than in 2014, but higher than in 2016 (Table 39). Copper deficiencies were lower in the Eastern Provinces, but selenium deficiencies and molybdenum levels were higher. According to Dr. Cheryl Waldner "If you are a cow-calf producer in Canada, you need to worry about copper supplementation in your herd regardless of your location."(BCRC, 2024f).

TABLE 39. PROPORTION OF COWS WITH SELECTED MINERAL DEFICIENCIES OR HIGH MOLYBDENUM

Mineral deficiency	West 2014	West 2016	West 2019	East 2019
Less than adequate copper	75.4%	54.3%	63.6%	59.7%
Copper deficient	42.9%	24.4%	29.0%	20.4%
Less than adequate selenium	21.8%	60.0%	33.8%	73.1%
Selenium deficient	0.4%	0.3%	0.2%	4.6%
High molybdenum	13.2%	9.4%	13.9%	15.0%

Source: Waldner et al., 2023.

The 2019 Adoption Rates Report suggested mineral supplementation was trending slightly down between 2014 and 2019 in Western Canada, although over 80% of operations provided supplements in the winter (BCRC, 2019a). This trend appears stable in 2022-23, with at least 82.9% of producers providing some form of minerals year-round, except in British Columbia (CCCS, Table 40). In comparison to the rest of Western Canada, 64.8% of producers in British Columbia provide mineral year-round, with 7.4% of producers providing mineral only in the summer (CCCS, 2024). Mineral supplementation provided during the winter is higher in British Columbia than in any other province, suggesting a seasonal mineral provision strategy amongst producers in that province. This could be due to limited access in forestry grazing leases and remote summer pasture locations.

Year-round mineral supplementation is highest in Ontario, with 91.2% of producers adopting the practice. Pogue et al. (2023) found higher moisture regions in Eastern Canada tended to have more leaching of

nutrients from forages. Soils in Eastern Canada are naturally selenium-deficient, and higher molybdenum levels in forages lead to a greater need for supplementation (Waldner et al., 2023).

Several options exist for trace mineral supplementation in Western Canada. The most common methods on summer pasture include: 33% of producers providing minerals solely via blocks and/or tubs, 27% offering loose mineral, 4.5% using both methods, and 44% not supplying any mineral supplement (Van De Weyer & Waldner 2011). In Western Canada, 23-26% of survey respondents fortified supplements in mixed rations, while in Eastern Canada, this ranged from 7-34% (CCCS, 2024). Additionally, just under half (44.7%) of 2022-23 CCCS respondents used chelated minerals (CCCS, 2024).

TABLE 40. PROPORTION OF OPERATIONS PROVIDING MINERALS

Region	2019 Adoption Rates Report (BCRC, 2019a)	2022-23 Canadian Cow-Calf Survey (CCCS, 2024) [e]	Trend
MT	97% provide minerals [a]	86.2% - minerals or vitamins - year-round, 22.4% - minerals or vitamins - during calving season, 17.2% - minerals or vitamins – summer only, 12.1% - minerals or vitamins - breeding season, 15.4% - minerals or vitamins - winter feeding, 0.0% - minerals or vitamins - other	?
QC	-		?
ON	72% - turnout to breeding, 65% - during breeding, 59% - after breeding, 60% - winter [b]	91.2% - minerals or vitamins - year-round, 15.4% - minerals or vitamins - during calving season, 11.0% - minerals or vitamins – summer only, 15.4% - minerals or vitamins - breeding season, 16.5% - minerals or vitamins - winter feeding, 0.0% - minerals or vitamins - other	↑
MB	69% - trace minerals - winter, 56-76% - trace minerals - summer [c], 82.6% - trace minerals - pre-calving (Saskatchewan) [d], 72.7% - trace minerals - post-calving (Saskatchewan) [d] 82% - minerals - winter, 60% - minerals – summer [c]	86.0% - minerals or vitamins - year-round, 22.8% - minerals or vitamins - during calving season, 15.8% - minerals or vitamins – summer only, 17.5% - minerals or vitamins - breeding season, 24.6% - minerals or vitamins - winter feeding, 1.8% - minerals or vitamins - other	↑
SK		82.9% - minerals or vitamins - year-round, 13.2% - minerals or vitamins - during calving season, 8.5% - minerals or vitamins – summer only, 11.6% - minerals or vitamins - breeding season, 20.2% - minerals or vitamins - winter feeding, 0.0% - minerals or vitamins - other	↑
AB		83.9% - minerals or vitamins - year-round, 23.7% - minerals or vitamins - during calving season, 11.4% - minerals or vitamins – summer only, 10.9% - minerals or vitamins - breeding season, 24.6% - minerals or vitamins - winter feeding, 1.9% - minerals or vitamins - other	↑
BC		64.8% - minerals or vitamins - year-round, 24.1% - minerals or vitamins - during calving season, 7.4% - minerals or vitamins – summer only 20.4% - minerals or vitamins - breeding season, 38.9% - minerals or vitamins - winter feeding, 1.9% - minerals or vitamins - other	↓

Sources: [a] 2017 ACCS (Maritime Beef Council, 2018); [b]2017 OCCS (University of Guelph, 2018); [c] 2013-14 WCCCS (Western Beef Development Centre, 2015); [d] Jelinski, 2015; [e] 2022-23 CCCS (CCCS, 2024).

Insights for Knowledge Mobilization

Perceived Status: Improving, but low adoption. Recommended strategy is to increase depth of adoption.

While a stable trend for mineral supplementation appears to exist across Canada, reported rates within Western Canada have varied. The WCCCS II (University of Saskatchewan, 2018) reported 60-83% of producers supplying minerals or vitamins to cows at some point during the year, while the 2022-23 CCCS indicated a range of 10.5-80.4% (CCCS, 2024). Similarly, the trend of supplying minerals or vitamins to cows annually in Eastern Canada also shows considerable variation across different reports. The OCCS (University of Guelph, 2018) indicated a range of 59-72%, while the ACCS (Maritime Beef Council, 2018) reported a high of 97%. More recently, the CCCS showed a broad range of 12.9-87.1% (CCCS, 2024). Survey results on precision livestock farming in North Dakota, South Dakota, and Texas found adoption rates low overall, but precision mineral supplementation was the leading practice at 18.8% (Wongpiyabovorn et al., 2025).

Barriers: Producers managing larger farms are more than twice as likely to provide mineral supplements (Lazurko et al., 2024). Limited information exists regarding why producers who forgo mineral supplementation choose to do so. However, the lack of discernible visual signs of deficiencies is likely a common underlying reason.

Resources: While the BCRC has released blog posts, webinars, and podcasts about how to navigate trace mineral supplementation (BCRC, 2024h), currently there is no page dedicated to this topic.

Opportunities: Communicating to producers that practices such as basic feed testing packages and BCS are insufficient for detecting trace mineral deficiencies. It is important to highlight that, even when cattle appear healthy, trace mineral deficiencies can lead to production declines, animal health events, and reproductive problems.

The trend of trace mineral deficiencies reported by Waldner et al. (2023) suggests there is room for improvement when it comes to providing trace minerals, and that free-choice mineral supplementation may not always be adequate. Monitoring intake from free-choice supplementation is difficult. To effectively correct deficiencies and ensure optimal bioavailability, producers might need to increase their reliance on total mixed rations, chelated minerals, or injectables. Finally, the persistent presence of mineral deficiencies despite high supplementation rates suggests an area of research for identifying more effective methods of supplementation (Wilcox et al., 2023).

FORAGE AND GRAZING MANAGEMENT

Grazing management varies greatly by region, herd size, and farm type (Alemu et al., 2016). Recommended grazing practices are diverse and specific to ecoregions, resource type (i.e., native or tame seed), and land base (i.e., large or small). Because producer surveys and studies define rotational grazing in a variety of ways, caution is necessary when interpreting their results.

Potential practices for forage and grazing management include:

- ***Grazing Management*.** Implementing rotational grazing to optimize forage utilization and improve pasture health.
- ***Forage Rejuvenation*.** Introducing legumes (e.g., clover, alfalfa) or improved grasses to increase forage quality, productivity, and/or nitrogen fixation.
- ***Cover Crops*.** Using cover crops on degraded soils to enhance soil structure, reduce erosion, and improve moisture retention.
- ***Extensive Winter Feeding*.** Extensive winter feeding spreads manure over a larger area, which can reduce manure hauling costs and lower greenhouse gas emissions, if manure and litter are spread broadly enough. However, extensive feeding can leave cattle exposed to extreme weather, requiring appropriate shelter from wind and cold temperatures.

GRAZING MANAGEMENT

Rotational grazing is a practice that involves dividing pastures into smaller sections and rotating livestock to a new section after a period of grazing, allowing the previously grazed area to rest and recover (BCRC 2017). This can involve frequent moves or longer intervals of 2-3 weeks or more, with varying stocking densities. This approach mimics natural grazing patterns, promoting healthy vegetation growth, and reducing soil erosion. By rotating pastures, producers can increase forage production, improve soil health, and decrease the need for fertilizers and pesticides. Additionally, rotational grazing helps to maintain biodiversity, supports ecosystem services, and sequesters carbon, making it a key strategy for sustainable agriculture and environmental stewardship.

Rotational grazing remained stable between 2021 (49%) and 2016 (49.7%) in all provinces except for Québec, Manitoba, and the Maritime Provinces which saw a slight decline according to the 2021 Census of Agriculture (CRS, 2024, Table 41).

TABLE 41. ADOPTION OF ROTATIONAL GRAZING BY PROVINCE, PERCENTAGE OF OPERATIONS

Region	2016	2021	Trend
Canada	49.7%	49.0%	↔
MT	c	50.7%	↔
QC	58.6%	59.0%	↑
ON	44.1%	43.8%	↓
MB	48.0%	49.1%	↑
SK	43.8%	43.4%	↓
AB	54.1%	52.4%	↓
BC	57.4%	55.7%	↓

Source: Statistics Canada, 2017 & 2022.

Results from the 2021 Farm Management Survey suggests a growth in rotational grazing adoption, as only 26% of pastures were grazed once per year or continually (CRS, 2024, Table 42). This difference may be due to producers understanding rotationally grazing being something more intensive than what they are doing, such as daily moves versus biweekly or monthly moves to new grazing paddocks or fields. Regarding grazing frequency, pastures were utilized once in 26% of cases, twice in 37%, three times in 19%, four times in 7%, and five or more times in 10% of instances. Approximately 6% of operations implemented less than three days of grazing time in each paddock, 6% of operations rotated every 3-7 days, 10% every 7-14 days, 18% every 14-30 days, 15% every 30-60 days, and 26% of operations implemented continuous grazing (Table 43).

TABLE 42. NUMBER OF TIMES PADDOCK WAS USED FOR GRAZING

Region	One Time		Two Times		Three Times		Four Times		Five Times or More	
	2017	2021	2017	2021	2017	2021	2017	2021	2017	2021
Canada	28%	26%	33%	37%	20%	19%	6%	7%	11%	10%
ON	10%	F	15%	F	30%	F	11%	F	33%	43%
MB	14%	F	40%	51%	24%	22%	12%	F	9%	8%
SK	36%	33%	37%	29%	16%	25%	x	F	8%	F
AB	33%	27%	35%	46%	19%	16%	5%	F	7%	F
BC	34%	28%	34%	x	16%	F	x	F	9%	F

Figures expressed as a percentage of the total beef cattle operations where most common grazing beef cattle were not kept in the same paddock for the entire grazing season.
Source: CRS, 2024.

TABLE 43. LENGTH OF GRAZING TIME IN A PASTURE BY WEEK AND MONTH

Region	Less than three days		Three days to less than week		One week to less than two weeks		Two weeks to less than a month		One month to less than two months		Two months more		Beef cattle kept in the same paddock	
	2017	2021	2017	2021	2017	2021	2017	2021	2017	2021	2017	2021	2017	2021
Canada	4%	6%	5%	6%	11%	10%	18%	18%	17%	15%	13%	x	28%	26%
ON	8%	F	10%	F	17%	F	11%	F	10%	F	8%	F	26%	36%
MB	1%	F	x	16%	11%	16%	24%	X	15%	x	12%	F	27%	25%
SK	F	F	5%	F	8%	9%	15%	23%	18%	15%	15%	x	33%	31%
AB	3%	F	4%	6%	10%	10%	20%	17%	18%	17%	15%	12	25%	20%
BC	8%	F	x	F	9%	F	19%	32%	19%	26%	10%	F	30%	18%

Figures expressed as a percentage of the total beef cattle operations with land for pasture.
Source: CRS, 2024.

The 2022 AALL survey (AALL, 2024) reported a higher adoption rate of rotational grazing at 69% among respondents, with regional differences showing the lowest adoption in southern Alberta (54%) and the highest in central Alberta (74.5%). These results may be biased towards the adoption of rotational grazing, as this is a priority within the living labs. The acreage adoption rate was reported to be lower in all regions as producers did not rotational graze on all their acres. Almost half of respondents (49.0%; n=71) indicated that paddocks were rested between 30 to 60 days before they were grazed again. Almost half of the respondents (49.7%; n=72) moved their cattle according to a time-based schedule and 47.6% (n=69) moved their cattle depending on the forage availability and condition. Out of the respondents that

reported that cattle were moved on a time-based schedule, none moved multiple times a day, 9.7% moved once every one to three days (n=14), 17.9% moved once a week (n=26), 11.7% moved once every two weeks (n=17) and 10.3% moved once more than every two weeks (n=15). Moving cattle to the next pasture was mostly triggered by either the current pasture having the top 50% of the vegetation grazed (37.2%; n=54) or 80% grazed (35.9%; n=52). Most survey respondents indicated that forage was typically grazed at the vegetative (3-4 leaf stage) growth stage (34.5%; n=50) or the mid-vegetative (post 4 leaf stage to flowering) growth stage (32.4%; n=47) in 2022 (AALL, 2024).

A study by the United States Department of Agriculture, Economic Research Service found that while 40% of US cow-calf operations report using rotational grazing, only 40% of those operations used intensive rotational grazing. Operations that retained ownership of feeder cattle (e.g. stockers) were the most likely to adopt intensive rotational grazing. Intensive rotational grazing operations have a significantly higher average stocking density (beef cattle per total operation grazing acres) than basic rotational grazing operations. Basic rotational grazing operations tend to have larger herds and more grazing land on average than either intensive rotational grazing operations or continuous grazing operations. Rotational grazing operations are more likely to participate in Environmental Quality Incentives Program (EQIP) and Conservation Stewardship Programs (CSP). Rotational grazing is more common in Northern Plains/Western Corn Belt and Appalachian regions (about one-half of operations) (Whitt and Wallander, 2022).

TABLE 44. LAND TENURE FOR CANADIAN BEEF PRODUCERS

Region	Area Owned		Area rented/leased from government		Area rented/leased from others	
	2021	Change from 2016	2021	Change from 2016	2021	Change from 2016
Canada	59.6%	↑	17.4%	↓	23.7%	↑
MT	46.9%	↓	12.2%	↑	35.5%	↑
QC	53.9%	↓	16.3%	↑	28.4%	↑
ON	65.4%	↓	18.5%	↑	19.3%	↓
MB	46.1%	↓	15.2%	↑	36.4%	↑
SK	55.8%	↓	17.4%	↓	25.2%	↑
AB	57.6%	↑	18.9%	↓	23.2%	↓
BC	54.9%	↑	14.4%	↓	28.6%	↑

Source: Statistics Canada, 2017 & 2022.

When comparing the 2016 and 2021 Census of Agriculture, there have been several significant changes concerning the area owned and area rented on farm operations (Table 44). In Eastern Canada more land was rented from government in 2021 than in 2016, while in Western Canada there was less land rented from government in 2021 than in 2016. Overall, in Canada there was an increase in area owned by producers (+2.1%), a decrease in area rented from the government (-2.8%) and an increase in area rented from others (+0.8%) (Statistics Canada 2017 & 2022).

Within the AALL, 70% of the land was owned by operations that rotationally grazed, and less than 30% was rented. With rotationally grazed rented land being typically under a long/secure tenure (39%) with a close connection to the landowner (44%) (AALL, 2024).

Land ownership influences the adoption of rotational grazing. Lessees are often reluctant to invest in permanent fencing and water infrastructure if they are not able to recoup the benefits of the investment's useful life. Chowdhury (2021) observed that producers who leased a smaller proportion of their land, particularly with more grassland owned, generally saw greater benefits from rotational grazing, including a higher proportion of grassland and a better ranch income ratio. In Québec and Manitoba, there was an increase in both categories of rented land, either from government or from others. There was also an increase in rotational grazing in both provinces. In Alberta and British Columbia, there was a decrease in rented land, and rotational grazing.

Insights for Knowledge Mobilization

Perceived Status: Close to peak adoption. Recommend supporting existing adoption with regular communications.

The adoption of rotational grazing is stable across Canada. Within Western Canada, rotational grazing has remained stable at 50% and in Eastern Canada, the trend has remained stable at 48% (CRS, n.d. -a).

Barriers: According to the AALL (2024) survey, producers cited various reasons for not implementing rotational grazing. The most significant factor was water availability (48.4%). Other deterrents included the expense of up-front investment (10.9%), an aversion to electric or portable fencing (9.4%), labour availability (3%), and a lack of knowledge on how to divide paddocks (3%). Within the *other* category, 20% of respondents cited sheep ownership as a barrier, while 33% mentioned renter, lease, or land agreements. These reasons for non-adoption are similar to those discovered in a recent qualitative questionnaire focused on the various financial, agronomic, socio-cultural, and awareness barriers to BMP adoption (Nature United, 2024).

O'Hara et al. (2023) noted that producers managing smaller herds are less likely to adopt rotational grazing and argued that factors including crop speciality, aging producers, and labour constraints all correlate to the decline in the practice adoption. The specialization in crop production can also lead to a decline in focus on livestock grazing, further reducing the adoption of rotational grazing. Older producers may be less likely to adopt new practices like rotational grazing, and younger producers may not have the experience or knowledge to implement it. Labour constraints are another significant factor. Rotational grazing requires more labour to move cattle and monitor pastures, which can deter producers with limited labour resources. Other reasons discouraging rotational grazing include: too many trees, hills, swamps or anything that makes cross-fencing a challenge, including rented land (Reynold Bergen, personal communication).

Resources: BCRC has a *Grazing Management* (BCRC, 2019b) topic page, a *Carrying Capacity* calculator (BCRC, n.d.-a), and a *Economics of Water Systems* (BCRC, n.d.-l) calculator.

Opportunities: There are two audiences for rotational grazing: first, producers who want to implement it and are looking for resources on how to set up fencing and water systems that work on their land (e.g., operations' context); second, producers who are already doing rotational grazing on a portion of their land but are looking for reinforcement on why it is valuable and should invest in expanding this practice to more land or how to adjust intensity to best suite their forage species and annual rainfall.

Educating producers on the other benefits that come with rotational grazing would appeal to custodians that are already concerned about land stewardship. Other surveys, such as the Canadian Cow-Calf Cost of Production Network and the 2023 BMP Survey (CRS, n.d.-c) noted that rotational grazing has other benefits including: increased resilience to drought recovery (71%), increased soil health (68%), increased number of desirable grass or legumes (54%), decreased runoff, and reduced soil erosion (46%).

The cost of portable fencing options, for internal cross-fencing, has decreased with the advent of electric rope (versus wire). Additionally, the use of virtual fencing is a niche practice with ongoing research and is still in early adoption in Canada due to commercial availability. Continuous research and communication of the potential of virtual fencing can help producers seeking new innovative rotational grazing management strategies.

FORAGE REJUVENATION

Rejuvenation refers to treatment aimed at enhancing the productivity of an existing forage stand and may include reseeding, sod seeding or overseeding, and fertilization of haylands or tame pasture (AALL, 2024). Without active management, many cultivated forage species have a productive lifespan of around four to five years before productivity declines due to aging stands and encroachment of undesirable or less productive forage species, as well as potential proliferation of weedy or woody vegetation.

Newly established forage stands initially exhibit high production and low maintenance requirements, but productivity may decline over time due to soil quality, moisture availability, species suitability, and management practices (BCRC, 2022). Assessing the status of the pasture or hayfield and evaluating past management decisions and soil conditions inform producers on the rejuvenation strategy. The presence of unwanted species could warrant the use of mowing, herbicide, or fertilizer, while a too low density of desired species might warrant sod seeding, overseeding with a legume, improved grazing management, or even a complete reseeding of the stand (BCRC, 2022).

Properly managed rejuvenation can increase forage yields and quality while reducing soil erosion and improving soil health. Additionally, this practice promotes biodiversity and supports ecosystem services. By rejuvenating pastures, producers may experience savings on feed costs and extend the lifespan of their pastures, maintaining productivity over time. Effective rejuvenation requires careful planning, implementation, and ongoing management, but it can be adapted to various pasture types and management systems. Conducting an objective assessment of the area in question, including a soil test is an important first step to maximizing future forage yield.

Establishment risk. For forage rejuvenation to work, an adequate amount of moisture is needed. This may be a reason why forage rejuvenation is more frequent in Eastern Canada and is seen less frequently seen in dryer areas of the Prairie Provinces.

TABLE 45. DURATION OF PRODUCTION FOR ESTABLISHED FORAGE STANDS

Region	1 to 2 years		3 to 5 years		6 to 10 years		More than 10 years		Unknown	
	2017	2021	2017	2021	2017	2021	2017	2021	2017	2021
Canada	5%	5%	42%	40%	30%	30%	20%	21%	3%	4%
QC	7%	4%	70%	66%	19%	26%	F	F	x	F
ON	9%	F	62%	61%	20%	22%	x	10%	x	F
MB	2%	F	27%	30%	39%	23%	23%	38%	8%	F
SK	F	F	20%	12%	29%	41%	42%	34%	x	8%
AB	F	5%	31%	30%	38%	34%	25%	29%	x	F
BC	F	6%	17%	19%	49%	43%	27%	26%	3%	6%

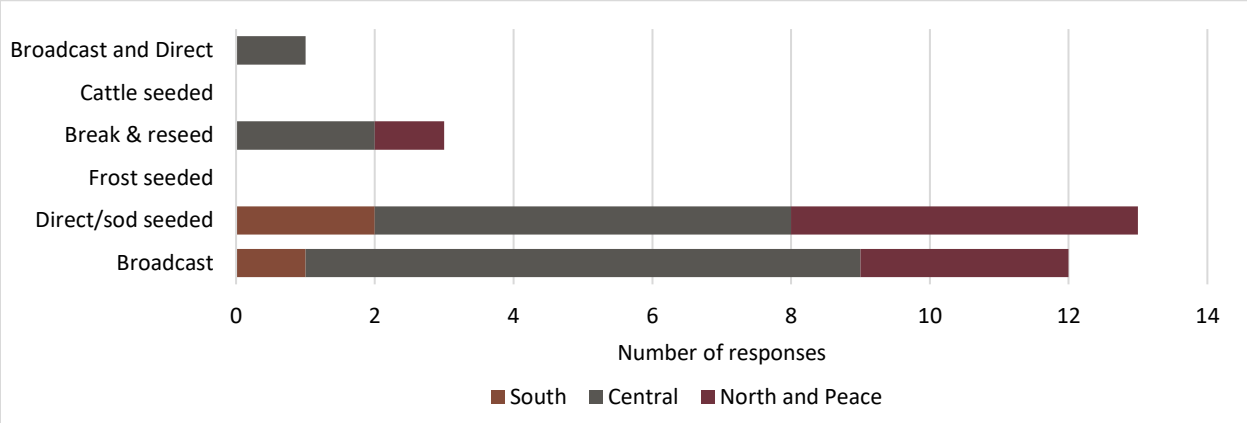
Source: CRS, 2022b

Blanks (x or F) suppressed to meet the confidentiality requirements of the Statistics Act or too unreliable to be published.

Stand Longevity. The 2021 Farm Management Survey respondents reported forage stands typically lasting between 3-5 years (40%), 6-10 years (30%), or over 10 years (21%) (CRS, 2022b). However, regional variations exist, with over 60% of operations in Western Canada reporting production beyond 6 years, whereas 60% of operations in Québec and Ontario reported having stands lasting 3-5 years. Notably, there has been a shift towards longer stand duration in Québec and Ontario, with the percentage of operations reporting 6-10 years of stand life increasing 7% and 2%, respectively (BCRC, 2022).

AALL (2024) survey defined sod seeding as the direct drilling of seed into land where little or no seedbed preparation has been made. Survey results reported a quarter of respondents re-seeded hayland. Most producers used direct/sod seeding (44.8%; n=13) and broadcasting (41.4%; n=12) to re-seed these areas.

FIGURE 21. METHOD OF SEEDING ON LARGEST ESTABLISHED HAYLAND AREA, BY REGION IN ALBERTA, IN 2022



Source: AALL, 2024.

Nutrient management on haylands involve strategic seasonal application, precise methods of application, and careful selection of nitrogen products. Seasonal application should be timed to coincide with periods of active plant growth to maximize uptake efficiency and to minimize losses due to leaching or runoff. For haylands, this often means applying fertilizer in the spring before the peak growth period, and potentially during other periods of rapid growth throughout the growing season. If soil tests indicate particularly low nitrogen levels, it's better to split the application into multiple phases to prevent runoff or leaching (BCRC, 2022).

About 36% of AALL (2024) respondents (n=41) indicated they applied fertilizer (synthetic, manure, or compost) to their managed haylands. From Lamothe and North Haven Solutions(2018) survey, 34% of respondents from Northern Ontario and 22% from Québec use commercial fertilizer on pasture. In Northern Ontario, 61% of hayland stands 1 to 5 years old and 50% of stands five-plus years old use commercial fertilizer. In Québec, these figures are 44% and 24%, respectively. In Eastern Canada, 41% of respondents from Northern Ontario and 50% from Quebec used manure as fertilizer on pasture. On hayland stands 1 to 5 years old, 42% in Northern Ontario and 60% in Québec used manure fertilizer. For stands five-plus years old, the figures were 38% and 58% in those regions, respectively.

Insights for Knowledge Mobilization

Perceived Status: Close to peak adoption. Recommend supporting existing adoption with regular communications.

Across Canada, there is a stable trend in forage rejuvenation, with producers appearing to be focused on stand longevity, by maintaining productivity through grazing management.

Barriers: The 2022-23 CCCS respondents who reseeded every one-to-10-years cited declining pasture productivity and the need for rejuvenation as the top reasons for their reseeding practices (CCCS, 2024). Producers who reseeded less frequently than every ten years or who have never reseeded indicated that they maintain pasture productivity through effective grazing management. Knowing the signs that indicate a pasture or hayland stand needs rejuvenation, and doing so economically, requires knowledge or expertise.

Resources: The BCRC has a *Forage Establishment* (BCRC, 2023b), *Improving Forage Yields* (BCRC, 2024e), *Rejuvenation of Hay and Pasture* (BCRC, 2022), a *Forage Species* topic page (BCRC, 2024a), and a *Forage U-pick* (BCRC, n.d.-f) tool.

Opportunities: Understanding the costs related to forage rejuvenation is key for financial success. With ranges from minimal to significant, depending on the operation and type of rejuvenation (CRS, 2025). By utilizing agronomists and various tools, producers can identify the rejuvenation strategies that best suit their operation and region.

COVER CROPS

Cover crops are typically diverse, annual plant mixtures, though they can include biannual or perennial species. They're seeded to cover the ground and improve soils. Cover crops can be grazed, baled, or used for silage, depending on producer goals (BCRC, 2024k). Cover crops are most often used by producers to improve soil health (80% in Prairie Provinces, 85% in Ontario), increase organic soil matter (76% in Prairie Provinces, 85% in Ontario), increase soil nitrogen (56% in Prairie Provinces, 43% in Ontario), and suppress weeds (53% in Prairie Provinces, 65% in Ontario) (Morrison & Lawley, 2021a; Morrison & Lawley, 2021b).

Between 2017 and 2021, the Farm Management Survey reported slight increases in fall or winter cover crop adoption across Canada, rising from 13% to 16% (CRS, 2024; Table 46). This increase was observed in every province, with Québec showing a notable jump from 19% to 27%. Holmes et al. (2017) identified mustard, oat, sudan grass (sorghum-drummondii hybrid), and buckwheat as the most effective crops for weed control in northern Illinois. Of these, only oats are regularly used in Canada as cover crops. Under drier conditions, drill seeding cover crops (e.g., Italian ryegrass and red clover) into an established winter wheat or winter rye stand yields better coverage than broadcast seeding (Edwards, 1998; Brennan & Leap,

2014). Alternatively, broadcast seeding may be a better option in wetter conditions because of higher soil compaction (Edwards, 1998).

TABLE 46. CANADIAN COVER CROP ADOPTION AND SPECIES BY REGION

Region	2017 (% of FMS respondents)	2021 (% of FMS respondents)	Western Canada (% of 2020 Prairie Cover Crop Survey respondents)	Ontario (% of 2020 Ontario Cover Crop Survey respondents)
Canada	13	16	Clover (any) – 57%	Oats – 63%
QC	19	27	Oats – 52%	Fall rye – 41%
ON	33	36	Peas – 41%	Radish – 39%
MB	4	6	Hairy vetch – 37%	Red clover – 31%
SK	-	3	Radish – 36%	Peas – 28%
AB	2	4	Ryegrasses – 36%	Crimson clover – 22%

Source: CRS, 2024.

Intercropping is defined as growing two species in the same field. Intercropping with legumes increases digestibility and enhances crude protein content and overall forage nutritional value, reducing the need for protein supplementation in beef cattle diets (Mbanysele et al., 2024; Omokanye et al., 2019; Martin et al., 1990; Zaman et al., 2002). Intercropping increases total biomass yield by up to 30% (Martin-Guay et al., 2018) and improves land-use and nitrogen-use efficiency (Chapagain & Riseman, 2014). Strategic crop combinations, such as barley-legume mixtures, naturally suppress weeds by shifting nitrogen uptake towards crops rather than weeds, reducing reliance on herbicides (Hauggaard-Nielsen et al., 2001; De Laporte et al., 2022; Ross et al., 2001). Intercropping improves soil moisture retention, reduces evaporation, and promotes deep root penetration, making it particularly beneficial in semi-arid regions (Mbanysele et al., 2024; Omokanye et al., 2020). Increased root biomass and organic matter improve soil structure and carbon storage (Martin-Guay et al., 2018; Wyngaarden et al., 2015), with 2:1 barley-pea intercropping arrangement sequestering carbon at rates 10% higher than barley monocrops (Chapagain & Riseman, 2014). Legume-based intercropping reduces synthetic fertilizer needs, lowering nitrous oxide emissions while improving overall greenhouse gas mitigation (Martin-Guay et al., 2018; De Laporte et al., 2022; Omokanye et al., 2020). The practice also reduces long-term feed and fertilizer costs while improving profitability through increased land-use efficiency (Chapagain & Riseman, 2014). Berseem clover's high biomass production and ability to suppress weeds suggest it could be an efficient dual-purpose forage and cover crop to reduce overall feed costs (Ross et al., 2001). Winter-feeding strategies using intercropped annual forages extend grazing seasons and reduce the reliance on stored forages, offering a cost-effective alternative for beef producers (Omokanye, 2014).

Companion crops are also a form of intercrops where a semi-annual, such as a clover, is planted with an annual to support the production of the main annual crop and has been lowly adopted across Canada (Table 47). Table 48 provides intercropping combinations that have been used in Canada.

TABLE 47. CANADIAN ADOPTION OF COMPANION CROPS

Region	2017	2021	Trend
Canada	8%	8%	↔
MT	x	x	-
QC	17%	18%	↔
ON	14%	11%	↓
MB	4%	5%	↔
SK	3%	3%	↔
AB	4%	7%	↑
BC	x	x	-

Source: Statistics Canada, 2021.
Blanks (x or F) suppressed to meet the confidentiality requirements of the Statistics Act or too unreliable to be published

TABLE 48. INTERCROPPING COMBINATIONS USED IN CANADA

Western Canada	Eastern Canada
• **Pea-Canola (Peaola).** Semi-arid regions; improves soil structure and nitrogen fixation but has challenges with grain separation and price variability (De Laporte et al., 2022; Mbanysele et al., 2024). • **Wheat-Pea.** Enhances soil health and improves biodiversity; commonly used in sustainable rotations (Hauggaard-Nielsen et al., 2001; Martin-Guay et al., 2018). • **Pea-Barley.** Found in clay-loam soils; increases forage yield and soil organic matter, with moderate weed suppression (Chapagain & Riseman, 2014; Mbanysele et al., 2024). • **Barley-Oats-Pea.** Enhances forage biomass; used in livestock feed; reduces reliance on synthetic fertilizers (Omokanye et al., 2019; De Laporte et al., 2022). • **Barley-Lentil.** Stabilizes yields in varied environmental conditions; increases total grain productivity and nitrogen cycling (Hauggaard-Nielsen et al., 2001; Chapagain & Riseman, 2014). • **Cowpea-Sorghum.** Moderate water efficiency; enhances soil fertility; well-suited for forage applications (Martin-Guay et al., 2018). • **Canola-Wheat.** Integrated pest management benefits; enhances biodiversity; moderate nitrogen-fixing benefits (Hummel et al., 2009).	• **Corn-Soybean.** Used in humid or irrigated areas; boosts protein content in silage; improves nitrogen use efficiency; requires minor equipment modifications (Martin et al., 1990; Zaeem et al., 2019). • **Red Clover-Wheat or Corn.** Used as a mulch crop and reduces nitrogen fertilizer requirements; enhances soil organic matter and grazing suitability (Wyngaarden et al., 2015).

Insights for Knowledge Mobilization

Perceived Status: Niche Practice. Recommend that knowledge mobilization resources be available for producers to learn about these practices, and for adoption be monitored. But recognize that the practice is only suitable and of interest to a subset of producers.

In Canada, the adoption of *intercropping* has been low but is growing slowly. On Western Canada field crop operations, the use of *fall or winter cover crops* has trended from 1% in 2017 to 4% in 2021, and the use of *companion crops* has trended from 4% to 5% (CRS, n.d. -b). Within Eastern Canda field crop operations, the use of *fall or winter cover crops* was reported to trend from 29% to 34%, and the use of *companion crops* in field crop operations has trended from 15% to 13% (CRS, n.d. -b).

Barriers: Research has identified four main barriers to adoption: lack of adequate moisture, seed selection and herbicide compatibility, cash crop market constraints, and lack of technical support. Additionally, the landscape, region, access to infrastructure and equipment, and land availability can also be barriers to establishing cover crops. Regions require enough moisture for both the second crop and the main crop the following year, a condition more easily met in Eastern Canada. Selecting intercrop species with compatible herbicide resistance and growth patterns is crucial to ensure effective weed management and ease of harvest. Certain intercrops, such as *Pea-Canola* (Peaola), face challenges with herbicide carryover effects and grain separation post-harvest (Hummel et al., 2009; Mbanysele et al., 2024).

Equipment modifications are often required for efficient separation and processing, (Cowell et al., 1989; Morrison & Lawley, 2021) and a lack of established markets for mixed/intercropped grains limit adoption (De Laporte et al., 2022). Farmers often lack access to technical guidance on species selection, seeding ratios, and herbicide compatibility, limiting intercropping adoption (Martin-Guay et al., 2018; Morrison & Lawley, 2021). Equipment modifications and complex field management deter widespread adoption, despite long-term benefits (Omokanye et al., 2019; De Laporte et al., 2022).

Resources: BCRC *Cover Crops* (BCRC, 2024k) Topic page. AgriService British Columbia Extension *Cover Cropping Guide* (Government of British Columbia, 2024).

Opportunities: Improve knowledge transfer on cover cropping and intercropping best practices and equipment needs (Morrison & Lawley, 2021). Develop region-specific guidelines to maximize intercropping efficiency based on soil, climate, and market access (Chapagain & Riseman, 2014). The Alberta AgriSystems Living Lab is working with producers on annual crops with clovers and interseeding for after-harvest grazing.

EXTENSIVE WINTER FEEDING

A winter management strategy involves providing adequate shelter, nutrition, and water to help cattle cope with harsh weather conditions. Winter feeding management also includes ensuring pregnant cows in the later stages of gestation inform the management system. This includes ensuring natural shelter or portable windbreaks are available to protect against wind, snow, and freezing temperatures. Implementing strategic feeding, such as providing extra energy and protein, is also necessary to mitigate the effects of cold stress and support overall herd health. The *Beef Code of Practice* (National Farm Animal Care Council, 2013) requires that cattle have access to areas, either natural or man-made, that provide relief from weather that is likely to create a serious risk to their welfare, as well as providing additional feed to meet animals' increased energy requirements when facing cold stress.

There has been a general move away from confined feeding in corrals, where shelter was assumed to be present, towards in-field winter feeding. The 2021 Farm Management Survey indicates that 61% of producers utilize in-field grazing or feeding after November, with the highest adoption (61-70%) seen in the Prairie Provinces (CRS, 2024, Table 49). This is down from 68% in 2017, with declines reported in all provinces included in the survey. Severe weather conditions such as wind and snow require shelter to provide cattle protection from the elements. The 2021 Census of Agriculture showed an uptick in the utilization of windbreaks and shelterbelts by producers, rising from 51.1% in 2016 to 65.7% in 2021.

Additionally, the use of residues or aftermath growth from harvested field crops increased, adopted by 55% of operations in 2021 (CRS, 2024, Table 50). Baled crop residue is utilized by 5.1% of beef cattle farm acres and is most commonly used in Ontario (8.1%) and Manitoba (7.6%, CRS, 2024).

TABLE 49. ADOPTION OF IN-FIELD WINTER GRAZING AND WINDBREAKS

Region	In-field grazing or feeding after November (FMS) [a]			In-field winter grazing or feeding (COA) [b]		Windbreaks or shelterbelts (COA) [b]	
	2011	2017	2021	2016	2021	2016	2021
Canada	39%	68%	61%	35.4%	39.2%	51.1%	65.7%
MT	17%	X	X	15.9%	21.6%	36.4%	52.8%
QC	6%	X	X	20.6%	24.9%	24.0%	36.1%
ON	17%	43%	34%	19.9%	21.8%	38.8%	51.8%
MB	54%	67%	61%	30.7%	35.4%	58.5%	76.6%
SK	65%	76%	70%	40.0%	42.3%	56.5%	70.9%
AB	62%	75%	66%	45.8%	49.3%	61.9%	75.1%
BC	45%	53%	68%	49.4%	54.5%	43.2%	57.2%

Source: [a] CRS, 2024; [b] Statistics Canada 2017 & 2022a.

TABLE 50. RESIDUES OR AFTERMATH GROWTH AND TOTAL BALE CROP RESIDUE LAND MANAGEMENT

Region	Residues or Aftermath Growth, % of operations (FMS)		Trend	Baled Crop Residue, % of total acres on beef cattle farms (COA)		Trend
	2017[a]	2021[a]		2016[b]	2021[b]	
Canada	X	55%	?	4.7%	5.1%	↑
MT	X	X		4.9%	6.9%	↑
QC	X	X		6.0%	6.9%	↑
ON	18%	32%	↑	7.2%	8.1%	↑
MB	22%	48%	↑	5.9%	7.6%	↑
SK	32%	58%	↑	4.2%	4.7%	↑
AB	34%	59%	↑	5.3%	5.1%	↓
BC	33%	39%	↑	0.5%	0.8%	↑

Source: [a]CRS, 2024; [b]Statistics Canada, 2017 & 2022a.

The AALL reported that the majority of respondents (85.4%) are wintering their cows in large outdoor pastures (AALL, 2024). For first calf heifers, 28.3% were wintered in large outdoor pastures, with adoption rates ranging from 22.2% in the Southern Alberta to 2.73% in Central Alberta. Additionally, 26.9% of respondents indicated that backgrounding cattle were kept in outdoor confined areas.

The 2022 AALL survey (AALL, 2024) found that bale grazing (15.9% of respondents, 1.7% of acres), swath grazing (11.2%, 1.5%), stockpiled grazing (18.9%, 8.8%), and corn grazing (4.5%, 0.5%) had low adoption rates and minimal acres (Table 51). This implies that most in-field winter feeding is done with unrolled bales or delivery of other feeds to avoid losses to wildlife. Daily feed delivery reduces benefits to labour and fuel use compared to other winter feeding options, but maintains the manure hauling benefit.

TABLE 51. ADOPTION OF WINTER CONFINEMENT BY TYPE OF OPERATION IN ALBERTA

Region	Adoption Rate, in respondents (%)			Adoption rate, in number of cattle (%)		
	Cows in large outdoor pastures	First calf heifers in large outdoor pastures	Backgrounded cattle in outdoor confined area	Cows in large outdoor pastures	First calf heifers in large outdoor pastures	Backgrounded cattle in outdoor confined area
South	85.0%	22.2%	66.7%	84.7%	24.9%	78.3%
Central	85.5%	32.7%	66.7%	81.6%	26.7%	90.8%
North/ Peace	85.4%	26.1%	50.0%	93.2%	58.0%	98.7%
Total Alberta	85.4% (n=140)	28.3% (n=28)	26.9%	85.9% (n=21,044)	33.4% (n=1,390)	90.9% (n=29,232)

Source: AALL, 2024.

The AALL is evaluating the economic and environmental cost-benefits of swath grazing and bale grazing. These benefits vary depending on the production system, as well as the wildlife challenges that producers face. The need for a back-up plan means that many producers use extended grazing systems only for a portion of the winter, delivering feed daily during periods like calving. The average and median lengths of days used varied among bale grazing (139/149), swath grazing (80/51), stockpiled (87/60) and corn grazing (95/98) (AALL, 2024).

During the winter months of 2021, beef producers who grazed their cattle without supplemental feed did so for an average of 8.5 weeks. In contrast, cattle that were grazed with supplemental feed were on average supplemented for 8.6 weeks. On average, beef cattle spent 11.1 weeks grazing, with most feed brought on-site, a decrease from 13.6 weeks in 2017 (Statistics Canada, 2017 & 2022).

TABLE 52. AVERAGE TIME BEEF CATTLE OPERATIONS GRAZED THEIR CATTLE DURING WINTER WITH OR WITHOUT SUPPLEMENTAL FEED BROUGHT ON SITE

Average number of weeks	Winter grazing without supplemental feed brought on site		Winter grazing with supplemental feed brought on site		In an open field or pasture in winter, relying mostly on feed brought on site	
Region	2017	2021	2017	2021	2017	2021
Canada	X	8.5	X	8.6	13.6	11.1
ON	16.0	14.0	12.6	11.1	15.1	14.0
MB	11.8	9.1	12.1	7.8	13.4	10.2
SK	9.6	7.6	10.7	8.5	12.0	11.4
AB	9.2	8.0	11.0	8.3	14.5	10.6
BC	8.2	6.9	11.0	8.2	13.7	10.8

Source: Statistics Canada, 2021.

Insights for Knowledge Mobilization

Perceived Status: Decreased adoption but close to peak adoption. Recommend supporting existing adoption with regular communications.

Within Canada, there is a decreasing negative trend in the adoption of extensive winter feeding. In Western Canada, beef cattle operations that grazed or fed their cattle in an open field or pasture has trended from 74% to 70% (CRS, n.d. -b) between 2017 and 2021. In Eastern Canada, beef cattle operations that grazed or fed their cattle in an open field or pasture has trended from 43% to 34% (CRS, n.d. -b) between 2017 and 2021.

The continued use of windbreaks and shelterbelts is a positive trend. The adoption of bale grazing, swath grazing, stockpile, and corn grazing (i.e., extended grazing practices) are low compared to in-field feeding levels. This implies that most in-field winter feeding is done with unrolled bales or delivery of other feeds to avoid losses to wildlife.

Barriers: Feed losses to wildlife encourage producers to deliver feed daily instead of leaving it out during the winter months. The cost-benefit of different extensive feeding practices varies depending on upfront investments, such as winter water systems, which have economies of scale.

Barriers to extensive wintering management include: high labour and equipment costs associated with providing supplemental nutrition and maintaining infrastructure, limited access to resources such as shelter and windbreaks, and variable weather conditions that can impact cattle health and productivity (McMillan et al., 2020).

The decline in the use of natural tree bluffs and wooded areas for winter - a national drop of 10 percentage points - suggests challenges in maintaining traditional shelter methods. This decline was most significant in Ontario, where usage fell from 86% to 42% (CRS, 2024). The opportunity cost associated with land occupied by shelterbelts may also pose a barrier, as indicated by a Saskatchewan study (Kulshreshtha et al., 2018).

Resources: BCRC *Winter management of Beef Cattle* (BCRC, 2024p) topic page and *Extended Grazing* (BCRC, 2024l) topic page.

Opportunities: Wintering management for cattle involves strategies to ensure their health and productivity during the winter months. Effective winter management opportunities include providing supplemental nutrition to maintain cattle health and productivity wintering management for cattle involves strategies, including providing supplemental nutrition, to ensure their health and productivity during the winter months (Larson et al., 2019).

Communicate the results of the AALL analysis on cost-benefit of extended grazing practices on different production systems, including trade-offs producers may face.

ENVIRONMENTAL MANAGEMENT

Producers are stewards of the environment, managing land and livestock with care and responsibility. Environmental stewardship includes a wide range of on-farm practices. However, the available data only measures the four practices listed below and does not capture other activities that may reduce greenhouse gas emissions, improve soil carbon, biodiversity, or other environmentally beneficial practices.

Potential practices for environmental management include:

- ***Winter feeding manure management*.** When in-field winter feeding, producers should move the feeding location daily to avoid buildup of nutrients. And, when selecting winter feeding pastures, producers should evaluate soil fertility and the risk of spring runoff into waterways to determine when to move to a new location.
- ***Manure Testing*.** Manure is not a uniform product. It is heterogenous and variable, with many components such as straw, bedding and by-products of the animal's diet. Testing manure nutrient content allows for adjustment of application rates and prevents over-fertilization.
- ***Strategic Manure Spreading*.** Application rates should be selected based on soil and crops nutrient requirements, nutrient composition of manure, and the application method. Applying manure to pastures in fall or early spring maximizes nutrient uptake and minimize runoff losses. It is important to maintain buffer strips and avoid spreading manure near streams to prevent contamination.
- ***Recycling Bale Wrap and Twine*.** Collecting bale wrap and twine from feeding areas prevents plastic contamination or plastic-related disease. Participating in agricultural plastic recycling programs minimizes landfill waste and avoids emission of chemicals released from burning.

WINTER FEEDING - MANURE MANAGEMENT

Repetitively winter feeding cows in the same spot over several years can lead to a buildup of manure and nutrients, potentially contaminating water and affecting its quality. The recommendation is to frequently move feeding sites to more evenly distribute manure and avoid leaching of nutrients.

The percentage of operations placing feed in the same location every year decreased from 76% in 2017 to 32% in 2021, indicating a shift towards more varied winter feeding locations (CRS, 2024, Table 53).

TABLE 53. FREQUENCY THAT FEED IS PLACED IN THE SAME LOCATION FOR BEEF CATTLE DURING THE WINTER

Region	Every year		Every two years		Every three to five years	
	2017	2021	2017	2021	2017	2021
Canada	76%	32%	14%	7%	10%	3%
ON	87%	48%	-	-	-	-
MB	83%	23%	-	4%	-	-
SK	73%	28%	19%	9%	7%	-
AB	72%	33%	13%	7%	15%	2%
BC	82%	29%	9%	-	8%	-

Source: CRS, 2024.

Feed distribution throughout the winter was mixed, with Ontario shifting towards more frequent moves while the Prairie Provinces were more stable with smaller shifts to more frequent moves to new locations. Overall, 15% to 39% of producers were providing feed only once in the same location, with subsequent feedings always in a new location (CRS, 2024, Table 54). These data reflect a small shift towards more frequent moves in feeding location throughout the winter.

TABLE 54. FEED PLACEMENT OF BEEF CATTLE IN-FIELD OR PASTURE SINCE NOVEMBER

Region	Provided in the same location for the entire winter-feeding season		Provided several times in the same location and then moved to a different location		Provided only once in the same location, with subsequent feedings always in a new location		Other placement	
	2017	2021	2017	2021	2017	2021	2017	2021
Canada	16%	-	41%	-	39%	-	4%	-
ON	40%	28%	37%	33%	-	15%	-	-
MB	14%	15%	38%	36%	-	35%	-	-
SK	16%	17%	39%	39%	41%	33%	5%	-
AB	11%	9%	43%	45%	42%	36%	3%	-
BC	12%	8%	48%	40%	35%	39%	5%	-

Source: CRS, 2024.

Results from the 2022 AALL Baseline Adoption Survey indicate that 55.4% of respondents store manure (i.e., containment of manure in a controlled system until it can be safely applied to fields), with 29.6% using deep bedding (i.e., where bedding and manure is not regularly removed and thick bedding accumulates to keep cattle dry and clean), and 69.6% using stockpiling storage systems (i.e., manure is placed in a designated area where it remains undisturbed until utilized for fertilization) (AALL, 2024).

Insights for Knowledge Mobilization

Perceived Status: Improving, but low adoption. Recommendation is to increase depth of adoption.

There is a stable trend in winter feeding manure management at a national level.

In Western Canada, between 2017 and 2021, the trend for winter feeding practices was as follows: feed provided in the same location for the entire season remained at 13%; feed provided several times in the same location before moving trended from 41% to 47%; and feed provided only once in the same location, with subsequent feedings always in a new location, trended from 41% to 39% (CRS, n.d. -b).

In Eastern Canada, between 2017 and 2021, feed provided in the same location for the entire winter feeding season trended from 40% to 37% , feed provided several times in the same location and then moved to a different location trended from 37% to 43%, and feed provided only once in the same location, with subsequent feedings always in a new location currently is at 20% (CRS, n.d. -b).

Barriers: If the goal is to rejuvenate infertile soil with manure through strategic winter feeding locations, results may not be visible for several years. Therefore, using different locations each year for winter feeding may not be the producer's main objective. However, awareness of potential nutrient buildup and runoff is crucial for effective water source management.

Resources: BCRC *Winter management of Beef Cattle* (BCRC, 2024p) and *Manure Nutrient Management* (BCRC, 2023c) topic pages.

Opportunities: Communicating strategies for selecting and rotating winter feeding locations, as well as feed locations throughout the winter will help avoid nutrient build-up. This could be complemented by providing pictures that helps producers identify nutrient build up. Informing their decision on when to move locations.

MANURE TESTING AND SPREADING

According to the 2021 Census of Agriculture, 38% of Canadian beef cattle operations applied solid manure as their nutrient source on forage lands, while 34% of beef cattle operations applied manure to pastureland (Statistics Canada, 2022a). On cropland for beef operations, broadcasting solid manure on the surface and working it into the soil was the most common practice (75%), significantly more so than not working it into the soil (32%).

TABLE 55. LAND MANAGEMENT, PERCENTAGE OF TOTAL ACRES ON BEEF CATTLE FARMS

Region	Commercial Fertilizer	Lime	Trace Minerals	Solid Manure *(Incorporated)*	Solid Manure *(Not incorporated)*	Liquid Manure *(Incorporated)*	Liquid Manure *(Not incorporated)*
Canada	27.6%	0.3%	2.1%	1.9%	1.4%	0.2%	0.2%
MT	21.4%	5.3%	--	5.3%	7.3%	0.2%[1]	0.7%
QC	15.3%	3.2%	0.6%	5.7%	10.5%	2.5%	5.3%
ON	35.7%	1.3%	5.8%	8.1%	5.1%	1.4%	0.7%
MB	33.0%	0.2%	2.1%	2.0%	1.2%	0.5%	0.1%
SK	32.2%	0.1%	2.4%	1.1%	0.9%	0.1%	0.0%
AB	25.1%	0.1%	1.7%	1.8%	1.0%	0.1%	0.0%
BC	6.1%	0.1%	0.4%	0.6%	0.6%	0.1%	0.1%

Source: Statistics Canada, 2022a.

[1] *Excludes Newfoundland and Labrador and Nova Scotia due to responses redacted for confidentiality.*

According to the 2021 Census of Agriculture, manure (solid or liquid, incorporated or not incorporated) was applied on 51.9% of beef cattle farms (cow-calf and feedlot operations), but this accounted for only 3.7% of beef cattle farm acres. This is a slight increase from 3.5% reported in the 2016 Census of Agriculture (Statistics Canada 2017 & 2022a, Table **56**). The highest proportion of manure use remains in Québec (24%), followed by Ontario (15.4%), and the Maritimes (10.7%). Western Canadian provinces show the lowest combined use, at 10.3% (Statistics Canada, 2022a). Overall, the trend has been generally stable, with a national increase offset by decreases only in the Maritimes and British Columbia.

The 2021 Census of Agriculture reports beef producers in Western Canada applied manure to fewer acres in 2021 (1.4-3.8%) compared to 2016 (1.6-3.5%). This may reflect the greater use of in-field winter feeding in Western Provinces, where manure is deposited directly on fields (see *Extensive Winter Feeding* section). Table 57 shows how manure testing is low and stable for both field crops and forage crops.

TABLE 56. MANURE LAND MANAGEMENT, PERCENTAGE OF TOTAL ACRES ON BEEF CATTLE FARMS

Region	Census of Agriculture (Land Manure)		Trend
	Past	Current	
Canada	3.5%	3.7%	↑
MT	11.5%	10.7%	↓
QC	21.9%	24.0%	↑
ON	14.2%	15.4%	↑
MB	3.5%	3.8%	↑
SK	2.1%	2.1%	↔
AB	2.6%	3.0%	↑
BC	1.6%	1.4%	↓

Source: Statistics Canada, 2017 & 2022a.

TABLE 57. BEEF CATTLE OPERATIONS WHERE SOLID MANURE IS TESTED FOR NUTRIENT CONTENT

Region	Field Crops		Trend	Forage Crops		Tend
	2017	2021		2017	2021	
Canada	15%	13%	↔	10%	11%	↔
MT	x	x	-	x	x	-
QC	x	x	-	x	x	-
ON	x	10%	?	10%	12%	↔
MB	18%	x	?	18%	8%	↓
SK	7%	7%	↔	6%	5%	↔
AB	18%	18%	↔	11%	16%	↓
BC	x	x	-	15%	6%	↓

Source: CRS, 2022b.
Estimated based on the percentage of operations that did not test solid manure.
Blanks (x or F) suppressed to meet the confidentiality requirements of the Statistics Act or too unreliable to be published.

Insights for Knowledge Mobilization

Perceived Status: Emerging or under-served topic. The recommended strategy is to provide knowledge mobilization that informs producers of new information as it becomes available, and identify knowledge gaps to be addressed through research.

A stable trend in manure testing has been observed across Canada. In Western Canada, the proportion of tested solid manure for nutrient contents used on field crops decreased slightly from 14% to 13. For forage crops, it remained stable at 10% (CRS, n.d. -b). In Eastern Canada, 10% of solid manure used on field crops is currently tested for nutrient content, while for forage crops, this increased from 10% to 12% (CRS, n.d. -b).

Barriers: Further research is needed to understand the barriers to adopting manure testing and to determine if producers' limited manure storage impacts the viability of such testing. In addition, provincial regulations govern manure storage and application, but their varying parameters across jurisdictions make knowledge extension resource development challenging.

Resources: BCRC *Manure Nutrient Management* (BCRC, 2023c) topic page.

Opportunities: Develop resources and communications around manure management tailored to producers in specific regions.

Solid manure testing provides information about the nutrients present prior to application. Nationally, 87% of beef operations do not test solid manure for nutrient content for field croplands, and 89% do not test when applying on forage croplands (CRS, 2022b). These numbers are similar to the 2016 Farm Management Survey (CRS, 2017a), which reported that nationally, 85% of beef operations do not test solid manure for nutrient content for field croplands, and 90% do not test it for forage croplands. This presents a significant opportunity for producers to test solid manure and soil before spreading, which can limit saturation and reduce the need for synthetic fertilizers.

RECYCLING

Plastic disease (i.e., software disease) has been brought to the Canadian cattle industry's attention. Cattle are curious and will chew on most objects interspersed within their feed. This can include twine and net wrap from bales. This material can plug the gastrointestinal tract leading to a slow health and production decline manifesting as weight loss, diarrhea, and eventual death. The best prevention strategy is to pick up every piece of plastic from pastures, including twine from broken bales, and removing twine and net wrap before using a bale processor to chop forage.

Burning hay bale net wrap is generally discouraged due to the toxic smoke and particulates it emits, posing environmental and health hazards for humans and cattle. Further, it is often made from recycled plastic, making it non-eligible or difficult to recycle or burn effectively.

In an Alberta 2019 survey, 68% of grain bag users and 56% of twine user respondents stated that they were very likely to participate in a government-funded pilot recycling program called *Alberta Ag-Plastic. Recycle it!* administered by Cleanfarms (Government of Alberta, 2019).

A 2023 survey in Alberta followed up on the same recycling pilot program (Stratus Ag Research, 2023) where 44% of respondents reported using and regularly disposing of plastic baler twine, compared to 46% in 2019. Among beef producer respondents, 80% of the respondents use and dispose of plastic baler twine, 75% use net wrap, 51% use silage plastic (including silo bags and bunker covers), and 35% regularly use bale wrap. Regarding disposal methods, 23% of respondents from the 2023 survey reported returning baler twine to a designated collection site for recycling, an increase from 13% in the 2019 survey. Net wrap recycling was reported at 20% in 2023, up from 9% in 2019. Silage plastic recycling was reported at 28% in 2023, up from 19% in 2019. However, in 2023, landfill (26%) and burning (25%) were also common disposal methods. For baler twine, 20% of respondents in the 2023 survey recycled their plastic waste, higher than 14% in 2019, but burning remained a more popular disposal method at 37%.

The Cleanfarms pilot project is one Canadian program aiming to overcome these barriers, thereby encouraging and simplifying agricultural plastic recycling. Cleanfarms' 2023 annual report indicates that pilot projects have been established across Canada to collect agricultural plastic waste for recycling. Québec producers returned 1.7 times more (1.47 million kg) twine and agricultural film in 2023 compared to the year prior. Saskatchewan recycled 21,700 kg of twine in 2023 through the pilot, which was an increase of 9% from 2022. Many other provinces have followed suit, such as Manitoba, which recycled 53,800 kg of bale wrap and similar plastics in 2023, and Alberta, where twine and other plastic recycling increased by 29% from 2022 to 2023 (Cleanfarms, 2023). These programs have brought awareness and increased adoption of recycling agricultural waste across Canada.

Insights for Knowledge Mobilization

Status: Improving, but low adoption. The recommended strategy is to increase depth of adoption.

In 2023, 44% of Alberta producers reported using and regularly disposing of plastic baler twine, compared to 46% in 2019 (Stratus Ag Research, 2023).

Barriers: The main reasons for forgoing recycling agricultural plastics are the lack of a nearby collection site, being too difficult, being too much labour to clean and sort, the collection site not accepting all agricultural plastics, and too many rules about returning agricultural plastics (Stratus Ag Research, 2023). Twine recycling requires a higher level of effort, including freezing and cleaning used twine, relative to its perceived benefits (Government of Alberta, 2019).

Resources: Cleans Farm site for provincial programs and pilots: https://cleanfarms.ca/.

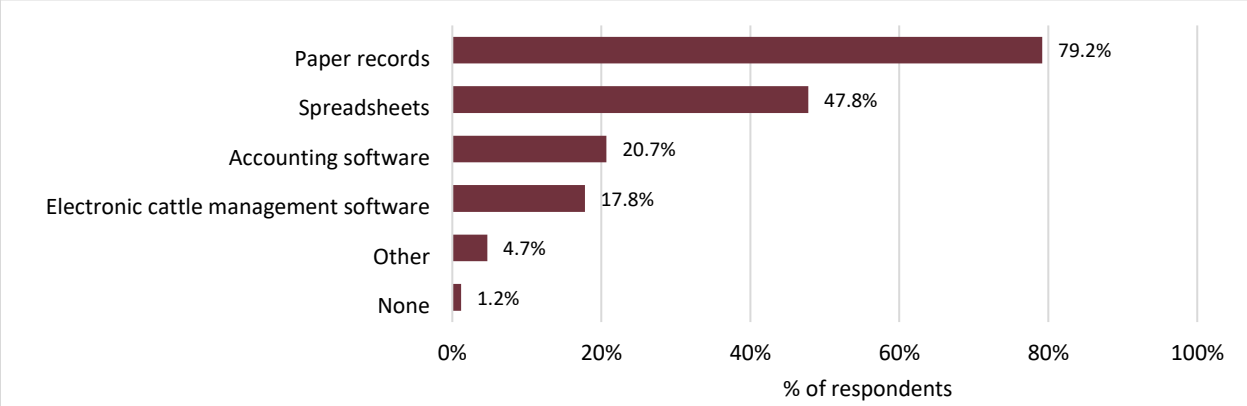
Opportunities: Encouraging participation in present recycling programs as an opportunity for recycling efforts and raise awareness of plastics disease.

ON-FARM RECORDS

Accurate record-keeping is a vital tool for producers to identify areas of improvement and benchmarking in their operations, whether at the herd or individual animal level. Producers with good record-keeping are associated with good husbandry (Escobar, 2015). Various types of records are used for both financial records and animal production records, including but not limited to forage and grazing, animal production, and animal health records.

Record-keeping and reporting are a significant challenge for producers, with the majority identifying it as a primary pain point in their operations (Makinde et al., 2022). Producers employ a variety of systems for record-keeping, ranging from traditional paper-based methods to digital solutions like spreadsheets such as Excel and accounting software such as QuickBooks (Makinde et al., 2022). Additionally, some producers utilize herd and feed management systems like Performance Beef, which automate feed record-keeping and cattle performance data calculations (Makinde et al., 2022). The adoption of these technologies is influenced by their ability to simplify data collection, analysis, and reporting, which are crucial for both business and regulatory purposes (Makinde et al., 2022). Despite the availability of these technologies, many producers require assistance to effectively learn and use them.

FIGURE 22. METHODS OF RECORD KEEPING USED BY CANADIAN BEEF CATTLE PRODUCERS



Source: CCCS, 2024.

In Canada, there is an increasing trend in the adoption of record-keeping. Lazurko et al. (2024) found that in 2020, 69% of respondents across Canada used individual female production records. Wong (2024) found that in 2022, 11% of respondents from Québec, Ontario, Manitoba, Saskatchewan, Alberta, and British Columbia used electronic records, 50% paper records, 34% both paper and electronic, and 4% did not keep animal production records.

Currently, within Western Canada, the current adoption rates are 77.6% for paper records, 47.9% for spreadsheets, 19.2% for accounting software, 18.7% for electronic cattle management software, while 1.1% of producers do not keep records (CCCS, 2024, Table 58). Compared to Pearson et al. (2019) in 2017, data from Western Canada (Alberta, Saskatchewan, and Manitoba) shows that 58.3% of producers keep records with a calving book or by paper, 37% transfer calving information on paper to a computer, and 6.3% record calving records directly on a hand-held electronic device.

In Eastern Canada, a high proportion of producers historically used paper-based systems: 89% (Maritime Beef Council, 2018), 70.3% (University of Guelph, 2018), and approximately 88% in Ontario and 80% in Québec (Lamothe and North Haven Solutions, 2018). The most recent 2022-23 CCCS shows a slight

decline, with 76.8% of producers in Eastern Canada still using paper records (CCCS, 2024). The use of electronic systems remains varied. In 2017, Lamothe and North Haven Solutions (2018) reported that 18% of producers in Ontario and Québec used electronic systems (e.g., smartphones or tablets), with additional uptake of Excel files (23% in Ontario, 24% in Québec), provincial traceability systems such as PATBQ (0% in Ontario, 32% in Québec), and other software tools like BIO, Gallagher TSI, and Feedlot Tracer. In the 2022-23 CCCS, 44.5% of eastern producers reported using spreadsheets, 23.9% used accounting software, and 14.2% used electronic cattle management software (CCCS, 2024). The proportion of producers who do not keep any records has remained low, ranging from 2% (Maritime Beef Council, 2018) to 1.9% (CCCS, 2024), with some historical regional variation noted by Lamothe and North Haven Solutions (2018) at 13% in Ontario vs. 2% in Québec.

TABLE 58. HISTORICAL VS CURRENT ADOPTION OF RECORD KEEPING BY CANADIAN COW-CALF PRODUCERS

Record Type	2017 OCCS (University of Guelph, 2018)	2015-16 Northern Ontario and Northern Quebec Cow-Calf Production (Lamothe and North Haven Solutions, 2018)	2016-17 ACCS, (Maritime Beef Council, 2018)	2022-23 Canadian Cow-calf Survey Eastern Canada (CCCS, 2024)	Pearson et al., 2019 [a]	2022-23 Canadian Cow-calf Survey Western Canada (CCCS, 2024)	2021 Record Keeping Survey (Wong, 2024) [b]
	2015-16 Survey	2015-16 Survey	2016-17 Survey	2022-23 Survey	2017 Survey	2022-23 Survey	2022 Survey
Paper records	70.30%	88% (ON) 80% (QC)	89%	76.8%	58.3%	77.6%	50%
Electronic records	15.84% electronic cattle management software, 11.88% use "other", including their own electronic spreadsheet-type program, or have so few in their herd that 'it's in my head',	18% (ON & QC) electronic (e.g. smartphone, tablet), 23% (ON) 24% (QC) Excel file, 0% (ON) 32% (QC) PATBQ, 9% (ON) 1% (QC) BIO, 1% (ON) 5% (QC) other electronic systems (e.g., Gallagher TSI, Archer, DSA Bovin, Club Conseil, Feedlot Tracer)	2%	44.5% spreadsheets, 23.9% accounting software, 14.2% electronic cattle management software	6.3%	47.9% spreadsheets, 19.2% accounting software, 18.7% electronic cattle management software	11%
Combination of paper & electronic records	-	-	-	-	37%	-	34%
No records	1.98%	13% (ON) 2% (QC)	2%	1.9%	-	1.1%	4%

[a] Pearson et al. (2019) adoption of record keeping is for 2016 calves only and within Alberta, Saskatchewan, and Manitoba.
[b] Surveyed producers in Quebec, Ontario, Manitoba, Saskatchewan, Alberta, and British Columbia.

The 2022-23 CCCS found that producers utilize records in various ways, with the primary purpose being informed decision-making on the farm (85.9%), and with nearly two-thirds (64.2%) also maintaining a farm journal to track activities (CCCS, 2024). This can be particularly valuable as it allows producers to go back to other years to review which areas are improving and which are not or may even be worsening. Additionally, records serve as a tool for financial analysis for 46.0% of producers, while 30.7% use them for qualification programs and 27.3% rely on them as supporting documentation when applying for financing (CCCS, 2024), demonstrating the multifaceted role record-keeping plays in agricultural management.

Wong (2024) found that among leading record keepers, 75% of respondents were considered to be *Level 1* record keepers (i.e., producers wanting to move from existing to excelling in the beef industry), 69% were considered to be *Level 2* record keepers (i.e., producers looking to transition from herd-level management to individual animal management), and 36% were considered to be *Level 3* record keepers (i.e., producers looking to manage their cost of production).

Calving records

Record keeping with respect to calving is widely adopted. Producers are keen to understand their herd's reproductive information for future use. This is a critical practice, as it aids in decision-making and monitoring herd health. Pearson et al. (2019) found most producers (58.3%) record calving information by using a calving notebook or paper records, while 37% transfer this information to a computer, and a small percentage (6.3%) enter data directly into electronic devices. The most recorded information includes the date of birth, calf identification number, and calving ease score, although less than half of the producers surveyed recorded birthweight or other details such as calf sex and coat color.

Lazurko et al. (2024) found that nearly all producers (98%) keep some form of calving records, with calf sex (98%), birth date (97%), calving assistance (96%), and calf and dam identification (93%) being the most common records.

These studies highlight opportunities to improve data collection, as many producers only record basic information, potentially underestimating herd-level incidences of calving assistance, morbidity, and mortality. This underscores the importance of comprehensive record-keeping to enhance herd management and health outcomes.

TABLE 59. RECORD-KEEPING PARAMETERS, PERCENTAGE OF RESPONDENTS MEASURING

Production Parameter	Manglai (2016)	Pearson et al. (2019)	Lazurko et al. (2024)
Birth date	98.6%	94.8%	97%
Calf sex	-	5.2%	98%
Calving assistance	-	-	96%
Birth weight	47.8%	43.8%	55%
Individual animal ID	92.8%	89.6%	93%

Source : Manglai, 2016; Pearson et al., 2019; Lazurko et al., 2024.

<u>Making Decisions with records can include:</u>

- ***Monitor Cost of Production.*** Operational costs such as track feed, health, and labour costs per cow to identify areas for improvement.

- ***Reduce Winter Feed Costs.*** Optimize grazing, minimize feed waste, and balance rations efficiently.
- ***Cull Unproductive Cows.*** Remove cows with poor reproductive performance or undesirable traits.
- ***Health Treatments.*** Identify chronic poor doers, withdrawal times, and multiple assisted births. Also, to inform and improve future animal health protocols.

Insights for Knowledge Mobilization

Perceived Status: Close to peak adoption. Recommend supporting existing adoption with regular communications.

Across Canada, paper-based record-keeping remains the most common method among cow-calf producers, but patterns of adoption vary by region. In Western Canada, there is a clear trend toward increased record keeping overall, with a growing proportion of producers adopting digital tools alongside traditional paper systems. As of 2022–23, 77.6% of producers use paper records, 47.9% use spreadsheets, 19.2% use accounting software, and 18.7% use electronic cattle management software (CCS, 2024); up from lower reported levels of digital use in 2017 (Pearson et al., 2019).

In contrast, Eastern Canada shows a more stable pattern, with decreasing reliance on paper systems, trending from 89% in Atlantic Canada in 2017 (Maritime Beef Council, 2018), 70.3% in Ontario in 2017 (University of Guelph, 2018), and roughly 88% in Ontario and 80% in Québec in 2015-16 (Lamothe and North Haven Solutions, 2018) to 76.8% as a Canadian average in 2022-23 (CCCS, 2024). Digital adoption remains mixed across regions, but the share of producers not keeping any records remains consistently low, typically under 2% (CCCS, 2024).

Barriers: Many producers only record basic information, limiting their ability to fully benefit from their time and efforts with informed, detailed records. The primary goal of record-keeping is to enhance profitability and efficiency. However, there is a need to better understand how producers utilize records to optimize their operations. On-farm benchmarking, whether formal or informal, relies on the type of records maintained. The majority of producers identify record keeping as a primary pain point in their operations (Makinde et al., 2022).

Resources: BCRC's *Record Keeping Course* (BCRC, n.d.-e) with three levels for animal health and performance, financials, forage and grasslands, and genetics.

Opportunities: Increase communication around the benefits of record keeping. Provide templates for producers to get started with. Provide examples and how-to videos demonstrating how these records are used in decision-making, ensuring any calculations are clear and carefully explained.

Lazurko et al. (2024) discovered that 79% of survey respondents established production goals, but only 64% set financial goals. Additionally, a higher percentage (91%) reflected on past financial performance than on past production performance (87%) when looking for areas to improve. This suggests that although production records are more commonly used day-to-day, financial data plays a greater role in strategic evaluation. However, separating financial and production record use may create a disadvantage, as aligning both is essential for setting effective, integrated farm management goals.

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APPENDIX

TABLE A. CLOSE TO PEAK ADOPTION/ PERFORMANCE

Close to peak adoption/ performance – support existing adoption with regular communications	
West	**East**
Calving Distribution: ↑ • Increasing positive trend • At target of 60% calving in the first 21 days • Percent of females calving in first 21 days: 55.0% in 2016-17 (University of Saskatchewan, 2018) to 60.4% in 2022-23 (CCCS, 2024) Percent of operations with a breeding season ≤63 days: 20% in 2016-17 (University of Saskatchewan, 2018) to 42.4% for heifers and 37.2% for cows in 2022-23 (CCCS, 2024)	***See Table D. Low Adoption**
Open rates: ↔ • Stable trend • Standard targets are 6% for cows, and 8% for heifers • Cow open rate: 8% in 2016-17 (University of Saskatchewan, 2018) to 7.6% in 2022-23 (CCCS, 2024) • Heifer open rate: 12% in 2016-17 (University of Saskatchewan, 2018) to 11.6% in 2022-23 (CCCS, 2024)	**Open rates**: ↓ • Decreasing positive trend – open rates are decreasing • On target: standard targets are 6% for cows, and 8% for heifers • Cow open rate: 10.9% in 2017 (University of Guelph, 2018) to 5.6% in 2022-23 (CCCS, 2024) • Heifer open rate: 8.1% in 2022-23 (CCCS, 2024)
Pregnancy Checking: ↔ • Stable trend • Heifers: 71% in 2016-17 (University of Saskatchewan, 2018) to 70.4%in 2022-23 (CCCS, 2024) • Cows: 62% in 2016-17 (University of Saskatchewan, 2018) to 66.0% in 2022-23 (CCCS, 2024)	**Pregnancy Checking**: ↔ • Stable trend • Heifers: 47% (Maritime Beef Council, 2018) and 64% (University of Guelph, 2018) in 2017 to 50.3% in 2022-23 (CCCS, 2024) • Cows: 47% (Maritime Beef Council, 2018) and 66% (University of Guelph, 2018) in 2017 to 54.2% in 2022-23 (CCCS, 2024)
Unassisted Calving: ↑ • Increasing positive trend • Unassisted calf births for cows: 79.0% in 2016-17 (University of Saskatchewan, 2018) to 95.5% (Waldner et al., 2024) • Unassisted calf births for heifers 63.0% in 2016-17 (University of Saskatchewan, 2018) to 83.8% in 2018-22 (Waldner et al, 2024)	**Unassisted Calving**: **?** • Unknown trend • Unassisted calf births for cows: 95.6% (Waldner et al., 2024) • Unassisted calf births for heifers: 75.6% (Waldner et al., 2024)
Breeding soundness exams and reproductive diseases: ↔ • Steady trend • Bull soundness exam: 72% in 2016-17 (University of Saskatchewan, 2018) to 71.4% in 2022-23 (CCCS, 2024) • Trichomoniasis bull testing: 25% in 2016-17 (University of Saskatchewan, 2018) to 29.9% in 2022-23 (CCCS, 2024)	*See Table C. Improving but Low Adoption

• Vibriosis bull testing: 22% in 2016-17 (University of Saskatchewan, 2018) to 25.7% in 2022-23 (CCCS, 2024)	
Recommended Calf Resuscitation: ↔ • Stable trend • Placing calves in the recovery position: 90.7% (CCCS, 2024) • Rubbing calves vigorously: above 90% in 2017 (Pearson, 2019) to 92.3% in 2022-23 (CCCS, 2024) • Poking nose with straw or finger: about 95% in 2017 (Pearson, 2019) to 94.5% in 2022-23 (CCCS, 2024)	**Recommended Calf Resuscitation: ?** • Unknown trend (2022-23) • Placing calves in the recovery position: 89.4% (CCCS, 2024) • Rubbing calves vigorously: above 84.9% (CCCS, 2024) • Poking nose with straw or finger: 85.6% (CCCS, 2024)
Dehorning/Castration – pain mitigation: ↑ • Increasing positive trend • Pain mitigation during dehorning: 55.0% in 2016-17 (University of Saskatchewan, 2018) to 67.0% in 2022-23 (CCCS, 2024) • Pain mitigation during castration: 28% in 2016-17 (University of Saskatchewan, 2018) to 45% in 2022-23 (CCCS, 2024)	**Dehorning/Castration – pain mitigation: ↑** • Increasing positive trend • Pain mitigation during dehorning: 50.0% (ACC, 2018) and 48.33% (University of Guelph, 2018) in 2017 to 82.1% in 2022-23 (CCCS, 2024) • Pain mitigation during castration: 10% (Maritime Beef Council, 2018), 26% (University of Guelph, 2018), and 16% (ON) & 9% (QC) (Lamothe and North Haven Solutions, 2018) in 2015-17 to 51% in 2022-23 (CCCS, 2024)

Vaccination: ↔
• Various trends
• 95% in 2016-17 (University of Saskatchewan, 2018) to 93.0% in 2022-23 (CCCS, 2024)
  ○ Stable trend for vaccinating cows for reproductive diseases
  ▪ 73.9% in 2016-17 (University of Saskatchewan, 2018) to 74.2% in 2022-23 (CCCS, 2024)
  ○ Decreasing trend for vaccinating cows for scours
  ▪ 66% in 2016-17 (University of Saskatchewan, 2018) to 42.7% in 2022-23 (CCCS, 2024)
  ○ Stable trend for vaccinating calves for Clostridial diseases
  ▪ 93% in 2016-17 (University of Saskatchewan, 2018) to 91.8% in 2022-23 (CCCS, 2024)
  ○ Decreasing negative trend for vaccinating calves for respiratory diseases
  ▪ 84% in 2016-17 (University of Saskatchewan, 2018) to 28.2% in 2022-23 (CCCS, 2024)
	Vaccination: ↔
	• Various trends
	• 72% (Maritime Beef Council, 2018), 70% (ON) & 72% (QC) (Lamothe and North Haven Solutions, 2018), and 84% (OCC, 2018) in 2015-17 to 88.4% in 2022-23 (CCCS, 2024)
	  ○ Increasing positive trend for vaccinating cows for reproductive diseases
	  ▪ 30% Vibriosis, 59% Lepto in 2017 (University of Guelph, 2018) to 72.2% in 2022-23 (CCCS, 2024)
	  ○ Stable trend for vaccinating cows for Scours
	  ▪ 30% in 2017 (University of Guelph, 2018) to 37.4% in 2022-23 (CCCS, 2024)
	  ○ Unknown trend for vaccinating calves for Clostridial diseases
	  ▪ 84.3% in 2022-23(CCCS, 2024)
	  ○ Unknown trend for vaccinating calves for respiratory diseases
	  ▪ 29.6% in 2022-23 (CCCS, 2024)

Parasite management: ↔
• Stable to decreasing trend
• External/Internal 85.6% (CCCS, 2024) [a]
  ○ External: 91% in 2016-17 (University of Saskatchewan, 2018) to 36.8% in 2022-23 (CCCS, 2024)
	Parasite management: ↔
	• Stable to decreasing trend
	• External/Internal 83.9% in 2022-23 (CCCS, 2024) [a]
	  ○ External: 26% (University of Guelph, 2018) and 84% (Maritime Beef Council,

○ Internal: 74% in 2016-17 (University of Saskatchewan, 2018) to 27.0% in 2022-23 (CCCS, 2024)	2018) in 2017 to 32.9% in 2022-23 (CCCS, 2024) ○ Internal: 70% (Maritime Beef Council, 2018), 67% (University of Guelph, 2018), 86% (ON) & 93% (QC) (Lamothe and North Haven Solutions, 2018) in 2015-17 to 23.2% in 2022-23 (CCCS, 2024)
Grazing Management: ↔ • Stable trend • Rotational grazing: 50.4% in 2016 to 49.5% in 2021 (CRS, n.d. -a) ○ Beef cattle grazing in paddock for less than a week: 7% in 2017 to 16% in 2021 (CRS, n.d. -b) ○ Beef cattle grazing in paddock for week to a month: 29% in 2017 to 31% in 2021 (CRS, n.d. -b) ○ Beef cattle grazing in paddock for a month or more: 32% in 2017 to 29% in 2021 (CRS, n.d. -b) ○ Beef cattle kept in the same paddock: 28% in 2017 to 36% in 2021 (CRS, n.d. -b)	**Grazing Management**: ↔ • Stable trend • Rotational grazing: 48.0% in 2016 to 47.9% in 2021 (CRS, n.d. -a) ○ Beef cattle grazing in paddock for less than a week: 18% in 2017 (CRS, n.d. -b) [b] ○ Beef cattle grazing in paddock for week to a month: 29% in 2017 (CRS, n.d. -b) [b] ○ Beef cattle grazing in paddock for a month or more: 17% in 2017 (CRS, n.d. -b) ○ Beef cattle kept in the same paddock: 26% in 2017 to 36% in 2021 (CRS, n.d. -b)
Forage Rejuvenation: ↔ • Stable trend • Duration of forage stands: ○ 1 to 2 years: 2% in 2017 (CRS, n.d. -b) ○ 3 to 5 years: 26% in 2017 to 24% in 2021 (CRS, n.d. -b) ○ 6 to 10 years: 37% in 2017) to 35% in 2021 (CRS, n.d. -b) ○ More than 10 years: 29% in 2017 to 31% in 2021 (CRS, n.d. -b)	**Forage Rejuvenation:** ↔ • Stable trend • Duration of forage stands: ○ 1 to 2 years: 8% in 2017 to 4% in 2021 (CRS, n.d. -b) ○ 3 to 5 years: 65% in 2017 to 63% in 2021 (CRS, n.d. -b) ○ 6 to 10 years: 20% in 2017 to 23% in 2021 (CRS, n.d. -b) ○ More than 10 years: 10% in 2021 (CRS, n.d. -b)
Record Keeping: ↑ • Increasing positive trend • Pearson et al. (2019) found that in 2017, in Western Canada (Alberta, Saskatchewan, and Manitoba), ○ 58.3% keep records with a calving book or on paper ○ 37% transfer calving information on paper to a computer ○ 6.3% record calving records directly on a hand-held electronic device • In 2022-23 the CCCS found (CCCS, 2024): ○ Paper records: 77.6% (CCCS, 2024) ○ Spreadsheets: 47.9% (CCCS, 2024) ○ Accounting software: 19.2% (CCCS, 2024) ○ Electric cattle management software: 18.7% (CCCS, 2024) ○ No records: 1.1% (CCCS, 2024)	**Record Keeping:** ↔ • Stable trend • Paper records: 89% (Maritime Beef Council, 2018), 88% (ON) & 90% (QC) (Lamothe and North Haven Solutions, 2018), and 70.3% in 2015-17 (University of Guelph, 2018) to 76.8% in 2022-23 (CCCS, 2024) • Spreadsheets: 44.5% (CCCS, 2024) • Accounting software: 23.9% (CCCS, 2024) • Electric cattle management software: 14.2% (CCCS, 2024) • No records: 2% (Maritime Beef Council, 2018), 1.98% (University of Guelph, 2018), 13% (ON) & 2% (QC) (Lamothe and North Haven Solutions, 2018) in 2015-17 to 1.9% in 2022-23 (CCCS, 2024)

[a] Within the 2022-23 S, there were three options for producers to choose from regarding parasite control (internal, external, and external/internal). Within historical surveys done in 2017, producers indicated if they used external or internal parasite control,

which limits the comparability across surveys and a significant decrease in adoption across internal and external parasite control is observed, but there was high uptake of external/internal parasite control in the most recent survey (CCCS, 2024).

[b] There was no Eastern Canada data from the 2021 Farm Management Survey due to low responses.

TABLE B. DECREASED ADOPTION/ PERFORMANCE BUT CLOSE TO PEAK ADOPTION

Decreased adoption/ performance but close to peak adoption – support adoption with regular communications	
West	**East**
Extensive winter feeding: ↓ • Decreasing negative trend • Beef cattle operations that grazed or fed their cattle in an open field or pasture: 74% in 2017 to 70% in 2021 (CRS, n.d. -b).	**Extensive winter feeding**: ↓ • Decreasing negative trend • Beef cattle operations that grazed or fed their cattle in an open field or pasture: 43% in 2017 to 34% in 2021 (CRS, n.d. -b).

TABLE C. IMPROVING, BUT LOW ADOPTION/ PERFORMANCE

Improving, but low adoption/ performance – Increase depth of adoption	
West	**East**
Body Condition Scoring: ↔ • Stable to improving trend • Hands-on method: 13% in 2016-17 (University of Saskatchewan, 2018) in 2022-23 to 12.6% (CCCS, 2024) • Visual method: 64% in 2016-17 (University of Saskatchewan, 2018) to 74.5% in 2022-23 (CCCS, 2024)	**Body Condition Scoring**: ? • Unclear trend • For the hands on & visual method: 17% (ACC, 2018), 23% (ON) & 50% (QC) (Lamothe and North Haven Solutions, 2018), and 26% (OCC, 2018) in 2015-17 to 15.5% hand-on and 65.8% visual in 2022-23 (CCCS, 2024)
Replacement heifer management: ↔ • Stable trend • Breeding season ≤63 days: 42.4% for heifers (CCCS, 2024) • Heifers bred before cows: 27.3% (CCCS, 2024) • Heifers calving length: 57 days in 2016-17 (University of Saskatchewan, 2018) to 57 days in 2022-23 (CCCS, 2024)	**Replacement heifer management:** ↔ • Stable trend • Breeding season ≤63 days: 26.5% for heifers (CCCS, 2024) • Heifers bred before cows: 20.4% • Heifers calving length: 49 days (ACC, 2018), 81 days (OCC, 2018) to 65 days (CCCS, 2024)
***See Table A. Close to Peak Adoption**	**Breeding soundness exams and reproductive diseases**: ↑ • Increasing positive trend • Soundness Exam: 7% (Maritime Beef Council, 2018) and 17% (University of Guelph, 2018) in 2017 to 23.5% in 2022-23 (CCCS, 2024) • Trichomoniasis bull testing: 1% in 2017 (University of Guelph, 2018) to 8.7% in 2022-23 (CCCS, 2024) • Vibriosis bull testing: 8.1% (CCCS, 2024)
Early Life Interventions: ? • Unknown trend • Vitamin and mineral injections administered to calves: 28.8% in 2022-23 (CCCS, 2024) • Tube feed colostrum shortly after assisted calving: 12.0% in 2022-23 (CCCS, 2024)	**Early Life Interventions**: **?** • Unknown trend • Vitamin and mineral injections administered to calves: 11.6% (CCCS, 2024) • Tube feed colostrum shortly after assisted calving: 22.1% (CCCS, 2024)

Calf Mortality: ↓ • Decreasing positive trend • Calf Death loss <24 hours from cows: 3.1% in 2016-17 (University of Saskatchewan, 2018) to 2.2% in 2022-23 (CCCS, 2024) • Calf Death loss >24 hours from cows: 2.2% in 2016-17 (University of Saskatchewan, 2018) to 2.4% in 2022-23 (CCCS, 2024) • Calf death loss from Scours: 11.6% in 2016-17 (University of Saskatchewan, 2018) to 11.1% in 2022-23 (CCCS, 2024) • Calf Death Loss from respiratory disease: 16.5% in 2016-17 (University of Saskatchewan, 2018) to 15.8% in 2022-23 (CCCS, 2024)	**Calf Mortality**: ↔ • Stable trend • Calf death loss <24 hours from cows: 1.56% in 2017 (University of Guelph, 2018) to 2.4% in 2022-23 (CCCS, 2024) • Calf death loss >24 hours from cows: 2.10% in 2017 (University of Guelph, 2018) to 2.8% (CCCS, 2024) • Calf death loss from Scours: 22.4% (CCCS, 2024) • Calf Death Loss from respiratory disease: 24.5% (CCCS, 2024)
Harmful Calf Resuscitation: ↓ • Decreasing positive trend • Hang calf upside down for a period of time: over 50% in 2017 (Pearson, 2019) to 35.2% in 2022-23 (CCCS, 2024)	**Harmful Calf Resuscitation**: **?** • Unknown trend • Hang calf upside down for a period of time: 30.5%% (CCCS, 2024)
Low-stress weaning: ↔ • Steady trend • Nose paddle two-stage weaning: 11% in 2016-17 (University of Saskatchewan, 2018) to 10% in 2022-23 (CCCS, 2024) • Fenceline weaning: 35% in 2016-17 (University of Saskatchewan, 2018) to 32% in 2022-23 (CCCS, 2024)	**Low-stress weaning:** ↔ • Steady trend • Nose paddle two-stage weaning: 20% (Maritime Beef Council, 2018), 5% (ON) & 2% (QC) (Lamothe and North Haven Solutions, 2018), and 14% (University of Guelph, 2018) in 2015-17 to 17% in 2022-23 (CCCS, 2024) • Fenceline weaning: 17% (Maritime Beef Council, 2018), 23% (ON & QC) (Lamothe and North Haven Solutions, 2018), and 22% (University of Guelph, 2018) in 2015-17 to 34% in 2022-23 (CCCS, 2024)
Veterinary Communication: ? • Unknown trend • 67.8% (CCCS, 2024) seek veterinary advice for a herd health program	**Veterinary Communication**: **?** • Unknown trend • 54.2% (CCCS, 2024) seek veterinary advice for a herd health program
Feed Testing and Ration Balancing: ↔ • Steady trend • Feed test occasionally or more frequently: 60% in 2016-17 (University of Saskatchewan, 2018) to 73.6% in 2022-23 (CCCS, 2024)	**Feed Testing and Ration Balancing:** ↑ • Increasing positive trend • Feed test occasionally or more frequently: 16% (ON) & 43% (QC) (Lamothe and North Haven Solutions, 2018), 26% (Maritime Beef Council, 2018), and 33.7% (University of Guelph, 2018) in 2015-17 to 50.3% in 2022-23 (CCCS, 2024)

Mineral Supplementation: ↔
• Stable trend
• Supply any minerals or vitamins to cows during the following period:
  ○ Year round: 80.8% (CCCS, 2024) [a]
  ○ Calving: 21.6% (CCCS, 2024)
  ○ Summer pasture: 60%-76% in 2013-14 (Western Beef Development Centre, 2015) to 10.5% in 2022-23 (CCCS, 2024)
  ○ Breeding: 15.0% (CCCS, 2024)
	Mineral Supplementation: ↔
	• Stable trend
	• Supply any minerals or vitamins to cows during the following period:
	  ○ Year round: 87.1% (CCCS, 2024) [a]
	  ○ Calving: 53% in 2017 (University of Guelph, 2018) to 18.7% in 2022-23 (CCCS, 2024)

○ Winter: 69%-82% in 2013-14 (Western Beef Development Centre, 2015) to 25.7% in 2022-23 (CCCS, 2024)	○ Summer pasture: 59% in 2017 (University of Guelph, 2018) to 12.9% in 2022-23 (CCS, 2024) ○ Breeding: 53% in 2017 (University of Guelph, 2018) to 16.1% in 2022-23 (CCCS, 2024) ○ Winter: 49% (OCC, 2018) to 18.7% (CCCS, 2024)
Winter feeding manure management: ↔ • Stable trend • Feed was provided in the same location for the entire winter-feeding season: 13% in 2017 to 13% in 2021 (CRS, n.d. -b) • Feed was provided several times in the same location and then moved to a different location: 41% in 2017 to 47% in 2021 (CRS, n.d. -b) • Feed was provided only once in the same location, with subsequent feedings always in a new location: 41% in 2017 to 39% in 2021 (CRS, n.d. -b)	**Winter feeding manure management**: ↔ • Stable trend • Feed was provided in the same location for the entire winter-feeding season: 40% in 2017 to 37% in 2021 (CRS, n.d. -b) • Feed was provided several times in the same location and then moved to a different location: 37% in 2017) to 43% in 2021 (CRS, n.d. -b) • Feed was provided only once in the same location, with subsequent feedings always in a new location: 20% in 2021 (CRS, n.d. -b) [b]

[a] Within the 2013-14 WCCCS (Western Beef Development Centre, 2015) and 2017 OCCS (University of Guelph, 2018) there was no option for year-round supplementations making the specific time periods for supplementation less comparable across historical surveys.

[b] 2017 data from the Farm Management Survey is not available.

TABLE D. LOW ADOPTION/ PERFORMANCE

Low adoption/ performance could be targeted with knowledge mobilization materials	
West	**East**
***See Table A. Close to Peak Adoption**	• **Calving Distribution**: ↓ • Decreasing negative trend • Calving in first 21 days: 54.0% in 2017 (University of Guelph, 2018) to 52.0% in 2022-23 (CCCS, 2024). Below target of 60% calving in the first 21 days. • Breeding season ≤63 days: 26.5% for heifers and 18.2% for cows (CCCS, 2024)
Implanting: ↑ • Increasing positive trend • 26.5% in 2016-17 (University of Saskatchewan, 2018) to 30.4% in 2022-23 (CCCS, 2024)	**Implanting**: ↑ • Increasing positive trend • 0.24% in 2017 (Maritime Beef Council, 2018), 2.4% in 2017 (University of Guelph, 2018) to 7.4% in 2022-23 (CCCS, 2024)
Growth – weaning weights: ↓ • Decreasing negative trend • Steers: 611 lb in 2016-17 (University of Saskatchewan, 2018) to 577 lb in 2022-23 (CCCS, 2024) • Heifers: 584 lb in 2016-17 (University of Saskatchewan, 2018) to 530 lb in 2022-23 (CCCS, 2024)	**Growth – weaning weights: ↓** • Decreasing negative trend • Male calves: 596 lb [a] (Maritime Beef Council, 2018), 444-708 lb [b] (Lamothe and North Haven Solutions, 2018), and 685 lb [a] (University of Guelph, 2018) in 2015-17 to 561 lb in 2022-23 (CCCS, 2024) • Heifers: 596 lb [a] (Maritime Beef Council, 2018), 360-680 lb [b] (Lamothe and North Haven Solutions, 2018), and 636 lb [a] (University of Guelph, 2018) in 2015-17 to 516 lb in 2022-23 (CCCS, 2024)
Water Testing: ↓ • Decreasing negative trend	**Water Testing: ↔** • Stable trend

• Water test at least every 3 years: 41% in 2016-17 (University of Saskatchewan, 2018) to 39.0% in 2022-23 (CCCS, 2024)	• Water tested in last 5 years: 41% (ON) & 17% (QC) in 2015-16 (Lamothe and North Haven Solutions, 2018) to water tested in last 3 years: 35.6% in 2022-23 (CCCS, 2024)

[a] *Weaning weight from cows only*

[b] *This range of weaning weights was pulled from the average weight of calf groups shown in figures 3 and 5 of Lamothe and North Haven Solutions (2018).*

TABLE E. EMERGING OR UNDER-SERVED TOPICS

Emerging or under-served topics	
West	**East**
Manure Testing: ↔ • Stable trend • Tested solid manure for nutrient contents for use on field crops: 14% in 2017 to 13% in 2021 (CRS, n.d. -b) • Tested solid manure for nutrient contents for use on forage crops: 10% in 2017 to 10% in 2021 (CRS, n.d. -b)	**Manure Testing**: ↔ • Stable trend • Tested solid manure for nutrient contents for use on field crops: 10% in 2021 (CRS, n.d. -b) • Tested solid manure for nutrient contents for use on forage crops: 10% in 2017 to 12% in 2021 (CRS, n.d. -b)

TABLE F. NICHE PRACTICES

Niche Practices	
West	**East**
Breeding technologies: ↑ • Increasing positive trend • Use of artificial insemination: 18% in 2016-17 (University of Saskatchewan, 2018) to 21.5% in 2022-23 (CCCS, 2024) • Use of embryo transfer: 5% in 2016-17 (University of Saskatchewan, 2018) to 5.5% in 2022-23 (CCCS, 2024)	**Breeding technologies**: ↔ ↓ • Stable to decreasing negative trend • Use of artificial insemination: 41% (University of Guelph, 2018) and 53% (Maritime Beef Council, 2018) in 2017 to 49.7% in 2022-23 (CCCS, 2024) • Use of embryo transfer: 12% (Maritime Beef Council, 2018), 15% (University of Guelph, 2018) in 2017 to 6.7% in 2022-23 (CCCS, 2024)
Retaining ownership: ↓ • Decreasing negative trend • 45% in 2016-17 (University of Saskatchewan, 2018) to 38.4% in 2022-23 (CCCS, 2024)	**Retaining ownership**: ? • Unknown trend • 44.3% (CCCS, 2024)
Remote Drug Delivery: ? • Unknown trend • Used once or more: 45.3% (CCCS, 2024)	**Remote Drug Delivery: ?** • Unknown trend • Used once or more: 7.7% (CCCS, 2024)
Cover Crops/ Intercropping: ↔↑ • Steady to increasing positive trend • Use of fall or winter covers crop in field crop operations: 1% in 2017 to 4% in 2021 (CRS, n.d. -b) • Use of companion crops in field crop operations: 4% in 2017 to 5% in 2021 (CRS, n.d. -b)	**Cover Crops/ Intercropping:** ↔↑ • Steady to increasing positive trend • Use of fall or winter covers crop in field crop operations: 29% in 2017 to 34% in 2021 (CRS, n.d. -b) • Use of companion crops in field crop operations: 15% in 2017 to 13% in 2021 (CRS, n.d. -b)