Selecting Heifers for Breeding

James Byrne, Beef Cattle Specialist, OMAFA

The backbone of a cow calf production system is the selection and integration of heifers into the beef herd. The replacement rate varies considerably between farms but on average lies between 10 to 20%. The decisions around which cow to cull ranges from age of cow, breeding success, calf quality, rearing success, temperament of cow, cow health etc. In the majority of cases, the age of the cow is the number one determinant on which cow should be culled.

Since the replacement heifer is the foundation of a productive cow herd, the choice of heifer and her development can greatly impact the economics of the farm operation through her genetics, future performance, and longevity. Time of first calving has a major influence on life time productivity, which is one of the most important traits to consider. Research has consistently shown that targeting first calving at 24 months maximises lifetime productivity, provided the cow continues to produce a calf each year. Research from Oklahoma State University College of Agriculture Sciences showed that heifers calving at 24 months produced 330 lbs of calf more over their lifetime than heifers calving at 36 months.

Picture 1: Heifers with breeding bull on pasture. James Byrne, OMAFA, 2025

To calf at 24 months, heifers must be bred by 15 months of age. The onset of puberty in cattle is determined by weight, age and breed. Weight is the major factor. The age at which puberty occurs is breed dependant with larger, later maturing breeds coming into puberty later than smaller, earlier maturing breeds.

Table 1: Weight (lbs) at which 14 – 15 month old heifers of different breeds reaches puberty.

% of heifers in heat	Angus	Hereford	Charolais	Angus x Hereford	Simmental x British	Lim x British
50	550	600	700	550	650	650
65 - 70	600	650	725	600	700	700
85 - 90	650	700	750	650	750	750

Source: J. Field, OMAFRA

Table 1 shows the effect of weight on the % of heifers in a herd at 14 – 15 months of age which show first heats, (onset of puberty). It demonstrates that earlier maturing breeds, i.e., Angus, Hereford, reach puberty at a lighter weight than larger framed breeds, i.e. Charolais, Simmental. Farmers should bear these target weights in mind when selecting heifers to breed. Larger framed breeds must weight heavier at the target breeding date, i.e. 15 months, compared to smaller framed breeds. Feeding the correct nutrition to heifer calves, taking into account breed, is important to ensure heifers reach their target weight by 15 months of age.

Replacement beef heifers should attain 65 to 70% of their potential mature weight by the time they are bred at 14-15 months of age. From weaning to first breeding, heifers should gain an average of 0.56 kgs to 0.80 kgs, (1.25 lbs to 1.75 lbs), per day or 115 to 160 kgs, (250 to 350 lbs), total (depending on breed). The 2022-23 Canadian Cow-Calf Survey noted that the average mature weight of beef cows in Canada is now 1,350 lbs. meaning that producers should aim for a breeding weight between 870 lbs and 950 lbs.

Lifetime productivity rates are affected by feeding management during critical phases. Research has shown that energy intake in excess of requirement can lead to the infiltration of fat into the developing udder which may restrict milk production in those heifers as cows later in life. Poor milk production leads to poor calf performance and earlier culling than planned for that animal.

Table 2: Nutrient Requirement for Replacement Heifers (growing at 1.25 lbs per day).

Medium Framed Heifers				Large Framed Heifers			
Body Weight (lbs)	**Dry Matter Intake (lbs)**	**Total Protein (lbs)**	**TDN (lbs)**	**Body Weight (lbs)**	**Dry Matter Intake (lbs)**	**Total Protein (lbs)**	**TDN (lbs)**
400	10.03	1.08	6.65	500	12.75	1.24	7.82
500	11.86	1.16	7.86	600	14.61	1.33	8.97
600	13.60	1.24	9.01	700	16.41	1.41	10.07

Source: J. Field, OMAFRA

Table 2 shows the ideal nutrient requirement of growing heifers at various body weights. Medium framed heifers have a lower feed requirement at the same weight as large framed heifers. Producers must be conscious of the frame type of heifer on their farm to avoid underfeeding or overfeeding.

Producers should plan breeding of heifers at least 2 weeks before breeding the rest of the herd. Heifers take longer to cycle post calving than mature cows. By allowing a 2-week gap at breeding, first calf heifers will likely show heats post calving at the same time as the main herd. A breeding season of 45 days is adequate for heifers provided they are in good nutritional status. Heifer open rates can be quite high. Canadian open rate for heifers is around 11%, compared to 7.4% for mature beef cows. Pregnancy checking is therefore critical to ensure that producers can maximise the value of heifers on their farms. Heifers retained for breeding, but subsequently prove open, are a very valuable commodity in today's cattle market.

The average heifer to bull ratio is Canada is 14:1. In Ontario this figure is 15:1. In order maximise any breeding success with heifers to ensure a low heifer to bull ratio. This has more to do with the age of the bull versus the age of cattle being bred. Yearling bulls are typically used on heifers so as not to exhaust the bull in it's first year of operation.

Heifers are very sensitive to calving difficulties. Research by Ontario Veterinary College has shown that on average 22% of first calf two year olds require assistance, and work by the University of Arkansas has shown that up 34% of first calf 2 year olds require assistance. Heifers must not be over or underfed as both conditions can lead to calving difficulties. The birth weight of the calf is related to genetics, less nutrition. Underfeeding will restrict the growth rate of heifers, reduce the size of the pelvis and increase the rate of calving difficulty. Overfeeding equally reduces the size of the birth canal due to excess fat deposition.

First calf heifers should be separated away from the main herd prior to calving. Calving should be monitored closely, but not obtrusively, to avoid increasing stress on the animal (which may delay calving), and provide assistance where necessary. The calving process tends to take longer in first calf heifers versus mature cows.

Always check that the newborn calf has sucked. First calf heifers are very inexperienced in allowing calves to suckle and assistance may be required. Great care must be taken when handling calves of heifers. A previously quite heifer may become extremely dangerous and unpredictable post calving.

The best method to reduce the risk of calving difficulties with first calf heifers is to breed heifers to an easy calving bull. Calving ease is the relationship between calf birthweight and cow pelvic size. Research has shown than in 80% of cases where calves die at birth, they were normal, and presented in the correct "diving" position, but the cause of death was suffocation. These types of deaths are primarily due to a mismatch between calf birth weight and dam pelvic size. Calf birthweight varies between breeds and within breeds, but a clear distinction exists between smaller framed, earlier maturing breeds and larger framed, later maturing breeds. Producers should select bulls with low calf birth weight when breeding heifers.

Pelvic measurements have been used by some producers as a means of selecting heifers for breeding. The University of Nebraska has developed ratios that can be used to determine the calf birthweight that a heifer could potentially successfully deliver. Measurements are taken at 12 to 13 months of age using a pelvimeter and from those measurements a maximum calf birthweight can be determined.

In Australia, pelvic measurements are primarily used as a culling tool to successfully identify abnormally small or abnormally shaped pelvises rather than as a breeding selection tool. These situations, if left unidentified, are associated with extreme calving difficulty, resulting in caesarean delivery and even death of the calf, cow or both.

Good selection and management of heifers for breeding is critical to the genetic advancement of the herd and the long term profitability of the beef farming enterprise.

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What is Johne's Disease Costing You?

Reducing the Economic Impact of Johne's Disease in Beef Herds

Lisa Sharko, Lead Veterinarian, Animal Health and Welfare, OMAFA

The prevalence of Johne's Disease (JD) in Canada is still low but rising in both Eastern and Western beef herds. Conservative estimates are that 6-8% of beef herds in Eastern Canada are infected, with 17-25% of animals positive within those herds. Other research suggests up to 3% of Eastern beef animals are positive and 15% of Eastern beef herds are infected with Johne's. Eastern herds in Canada have a higher prevalence than Western herds (~5% prevalence) possibility due to more dairy cattle in Ontario, higher pasture stocking densities, and winter confinement. Herds are at a particular risk of infection if they have dairy cattle on the same premises as beef cattle, have new herd additions, animals with low body condition score (BCS <2.5), or animals with JD symptoms in the last 3 years. Calves under 6 months of age are most at risk of infection from fecal-oral transmission of Mycobacterium avium subsp. paratuberculosis (MAP) which is the causative pathogen of Johne's Disease. Infections can be silent or subclinical before animals start showing sign of clinical disease, such as, decreasing BCS and watery diarrhea.

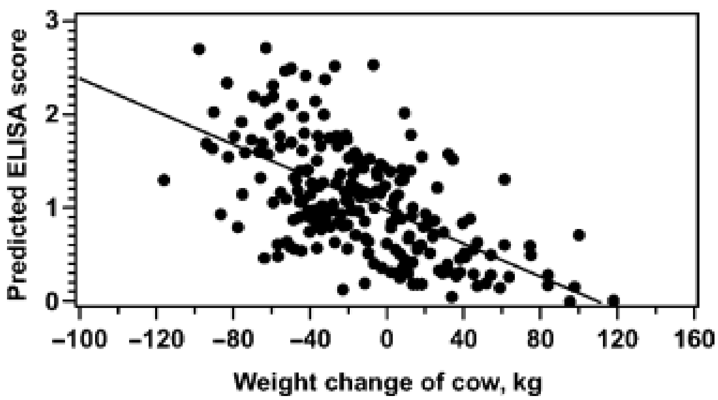

Figure 1. Mean predicted ELISA scores by weight change of cow between Nov and May weights. (Elzo et al.)

Infection with Johne's increases culling risk and posses a source of economic loss. Results from cows tested using the blood ELISA test are reported as negative, suspect, low-positive, positive, and strong-positive. The more positive the cow, the bigger the impacts of disease and economic loss. Cows that are strong-positive are shedding high levels of MAP into the environment. These highly positive cows have decreased cow weights, and their calves have smaller birth weights and decreased preweaning gains. As seen in Fig. 1, the more strongly positive a cow is on blood ELISA, the greater her weight loss is through the calving period. Calves from strong positive ELISA cows have a 21.48 kg decrease in 205-day adjusted weaning weights (AWW). In 2013, the estimated economic loss from calves of strong positive dams was $57.49 USD (Table 1.). That value was calculated in the study using $2.68 USD/kg as the mean value of feeder calves determined by the National Agricultural Statistics Service from 2007-2011 in the USA. Today's increasing beef market only amplifies the potential economic loss from disease. At a current Ontario feeder calf value of $8.71/kg, ($3.96/lbs), a 21.48kg decrease in AWW results in a $187 loss in potential revenue. The negative impact on calf size and growth is possibility due to JD impairing nutrient absorption, decreasing a cow's BSC, and decreasing milk production. Cost-benefit models exist and can be used to evaluate the cost of culling, testing, and the cost of herd management changes. It can also compare the cost of disease prevalence with or without control measures in place.

ELISA Interp. Method	No. Cow-Calf	ELISA Interpretation	Decreased AWW (kg)	P Value	Estimated Economic Loss in USD
Dichotomous	192	Positive	5.53	0.016	$14.81
Categorical	321	Suspect	2.78	0.139	$7.43
	153	Positive	2.85	0.261	$7.64
	39	Strong-Pos	21.48	<0.001	$57.49

Table 1. Mean decrease in AWW (205-day adjusted weaning weights) and associated economic loss for calves born to beef cows that were ELISA positive, compared to calves born to ELISA negative cows. (Bhattarai et al.)

It is essential to work with your herd veterinarian if you are worried about the potential presence of JD within your herd. Together you can complete testing to estimate the prevalence in your herd and perform a Risk Assessment Management Plan (RAMP) to make a list of ~3 high impact recommendations for disease reduction that can be put in place. Calving area management and managing additions/herd replacements should be a large focus of this RAMP since they pose some of the highest risk. Additionally, you can create an action plan and establish a regular testing program to reduce or eradicate JD in your herd. Test type, testing strategies, and the type of your herd (commercial verses registered) should be considered. A commercial cow-calf operator's goal may be to focus on disease reduction and control while a registered herd is recommended to test to eradicate the disease.

The two most preformed tests are fecal PCR (individual or pooled samples) and blood ELISA. Individual fecal PCR had a sensitivity and specificity of 96% and 98%, respectively, which is more sensitive than blood ELISA (35% sensitive). Fecal PCR is highly specific meaning positive results can be trusted as positive. Blood ELISA tests are significantly cheaper than the fecal PRC tests but need to be confirmed by fecal PCR before a culling. Pooled fecal PCR tests can also be preformed if the herd prevalence is estimated to be low, which helps reduce testing costs. In consultation with your veterinarian, the test performance and price, herd goals, and perceived herd prevalence should all be considered before moving forward with testing.

Taking into consideration the rising prevalence of MAP in Eastern Canada and the rising economic impact of disease, now may be the right time to investigate the possible presence of MAP within your herd. An action plan created with your veterinarian can help measure the prevalence of MAP and implement best management practices to decrease the economic impact of Johne's disease in your herd.

Additional Tools: Beef Cattle Research Council: Johne's Testing Decision Tool & Johnes.org

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Do beef heifers previously classified as high or low methane emitters respond the same to a canola oil methane mitigation strategy?

Dr. Katie Wood, Associate Professor, Animal Biosciences, University of Guelph and Katie Kroeze, Ph.D. Student, Animal Biosciences, University of Guelph

Lowering greenhouse gas (GHG) emissions is a topic of much conversation in the Canadian beef industry with goals set by the Canadian Cattle Association to lower GHG emissions by 33% by 2030 and the Canadian Government goals of net 0 emissions by 2050 (Canadian Cattle Association 2024; Government of Canada, 2023). Many feed additives have been previously studied and concluded to reduce the methane emissions of beef cattle such as: high starch diets, red seaweed, 3-NOP, dietary lipids, etc., (Grainger & Beauchemin, 2011; Storlien et al., 2017; Vijn et al., 2020). These feed additives can be expensive, and even the cheapest adds a cost to the producer. However, within the herd individual animals may already have lower than average emissions, and the question remains if all individuals will benefit from a feed additive to reduce emissions or if a more targeted approach is required.

This may be a potential application for precision agriculture systems for the beef industry. Some precision agriculture techniques have been adopted in other sectors such as dairy and swine. For example, in dairy, milking robots can collect animal health and production data as the cow is being milked and offer a supplement in the robot to match the individual cow's nutritional requirements. If high emitting animals within the herd can be identified, a precision feeding approach may be able to help keep overall supplementation costs low, by target feeding only the animals that will benefit from a supplementation strategy.

Therefore, one of this experiment's goals was to determine if the whole herd needs to be fed a dietary mitigation strategy or if only the high emitters of the herd would benefit from a supplement. Canola oil was chosen for this experiment due to its consistent success in reducing emissions in previous studies (Beauchemin & McGinn, 2006; Beauchemin et al., 2007; Beauchemin et al., 2009; Storlien et al., 2017; Avilés-Nieto et al., 2023) and due to Canada being the world's largest producer of canola (Barthet, 2016).

 ***Image 1:*** *Heifer with her head in a GreenFeed trailer (C-Lock Inc) having her greenhouse gas emissions recorded*

This study compared the heifers' methane mitigation response to canola oil added at 6% of dry matter intake, (DMI), after first being classified as high or low methane emitters within the herd. First, the GHG emissions of the heifer's methane emissions were measured using a C-Lock Inc. GreenFeed Trailer (seen in image 1), when consuming the same high forage total mixed ration (TMR). This group of 64 heifers was then divided into two groups, either high (31.8 ± 1.68 g CH_4/kg DMI) or low (26.1 ± 2.46 g CH_4/ kg DMI) methane emitters. After this division, the heifers were fed either the control diet with no canola oil or the treatment diet with canola oil added at 6% DMI in a treatment arrangement as seen in Figure 1.

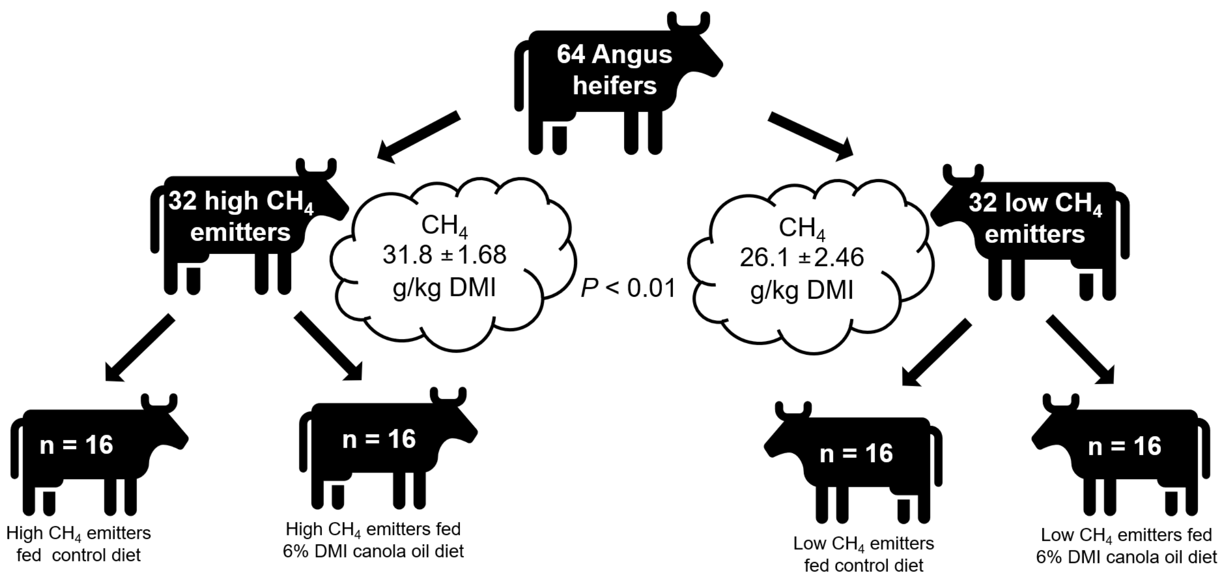

Figure 1. *Infographic describing 2x2 factorial heifer grouping during trial*

This study found that canola oil supplementation did reduce methane emissions across all heifers. There was no statistically significant reduction in methane emissions when looking at the interaction of the methane classification and the diet. However, when the magnitude of reduction is looked at, the high emitters on the canola oil diet's emissions are reduced by 10.2%, whereas the low emitters on the canola oil diet's emissions were reduced by less than half of that at 4.5% as seen in Figure 2.

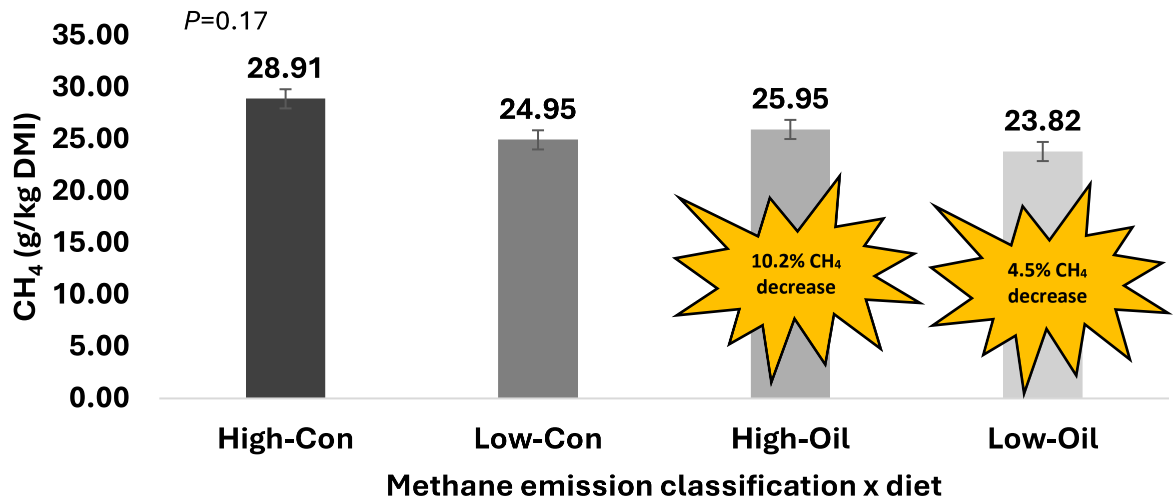

Figure 2. *Enteric methane (g/kg DMI) from beef heifers classified as high or low methane emitters fed either a control or 6% DMI canola oil diet*

Though the technology isn't yet readily accessible for producers to measure their animal's methane emissions on farm, this precision feeding approach may be useful in the future to save cost when feeding methane reducing feed additives. Further research on different ways to classify high and low emitters, new technologies to identify methane emissions from individual animals on farm, as well as how different feed additives may affect individual animal response should be done to deepen the understanding of this interaction.

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My Animal Agriculture and Beef Production University Training Compared to My Work Experience with OMAFA.

Cate Thompson, OMAFA SEO 2025 Livestock Assistant - Beef

As a Beef Cattle Assistant with the Ontario Ministry of Agriculture, Food and Agribusiness, I am learning valuable information through hands-on experiences that cannot be replicated in a student's formal education setting. The beef industry is particularly unique in involving a complex integration of efforts from multiple sectors to successfully finish with a high-quality product. The in-depth investigation of these aspects of the industry requires forming connections between sectors, seeing gaps in personal knowledge, and analyzing where improvements can be made within the industry.

Before I share my experiences of beef education, I would like to introduce myself and give background information on the origins of my perspectives. I have just completed my third year in Animal Biology at the University of Guelph. I had transferred from the Biological Science major after deciding that I was more interested in pursuing a career in animal health and management rather than human health. Coming from a non-farming background, my university education was where I was first provided with in-depth exposure to animal agriculture including beef production systems. Before my second year of university, I had minimal experience in animal agriculture, barring observing livestock shows at fairs and touring local farms.

Through university I've had great experiences from learning in labs and field trips to supplement lecture content. One observation I have with university experiences is that there is an emphasis on learning and conducting research in controlled environments to reduce confounding variables in a study. Although this is a very necessary aspect of reviewing the significance of the specific treatment application in question, it removes the observer from the inevitably unpredictable nature of agricultural operations. I have learnt that even in the most "real-life" research setups in university, the application of research knowledge meant to improve commercial production to operations across the province can be limited. The gap in the transfer of knowledge between researchers and producers is multi-faceted, and I do not believe a student can truly appreciate the effort required in applying new technology or management practices on a farm unless they spend time directly interacting with producers and learning about their specific operation.

A study of undergraduate students taking a dairy management course at Colorado State University investigated the differences in student's knowledge and performance when they were taught via case-based teaching compared to a traditional lecture-based environment. Although there was no significant difference in student performance taught through a case-based teaching method versus a traditional lecture-based environment, feedback provided demonstrated that students appreciated case-based studies as a follow-up to content learnt in lecture (Ferree 2022). This is like courses I have taken at the University of Guelph, where students are introduced to a specific topic in animal science prior to taking a field trip to investigate the subject in greater detail. This allows for meaningful connections during tours and in-depth conversation, after students already have a solid foundation of the topic prior to seeing it in practice.

Picture 1: University of Guelph undergraduate class tour of the Ontario Beef Research Centre, Cate Thompson, OMAFA, 2025

Working at OMAFA as a summer student has encouraged me to form questions that ask "why" and "how." I have always been an inquisitive person, but until learning firsthand from producers, I did not fully understand the extent of my questions and concerns. Although critical research is conducted through both University and OMAFA positions, they are quite different in terms of recognizing the practicality of generalizing technological, research and KTT applications in day-to-day life, especially within the beef industry. I do not believe that one setting is necessarily better than the other for educational success, but I genuinely think that from a student's perspective, being involved in both positions is necessary to fully understand the extent of the production system and to apply research effectively within the industry.

This highlights the importance of Knowledge Translation and Transfer (KTT) as practicality in application is emphasized. Good research can be conducted at many levels and with varying complexity, but if producers are not able to apply this, I wonder if the research is truly maximizing its potential value.

Throughout these past few weeks as a summer student for OMAFA, I have gained a greater appreciation for the importance in considering development, application, and practicality in a conventional beef setting in Ontario. With background knowledge from valuable courses at the University of Guelph, I am looking forward to a summer of new experiences and forming meaningful connections with producers and stakeholders in the industry.

Picture 2: OMAFA members walking through a feedlot barn with cattle. Cate Thompson, OMAFA, 2025

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