An economic model for cow-calf producers to determine the cost-benefit of pregnancy testing

Prepared for:
CanFax Research Services

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EXECUTIVE SUMMARY

This report presents an economic model that can be used by cow-calf producers in Western Canada to determine the cost-benefit of pregnancy-testing for their herd. Producers can enter data about their herd and management practices, and the model will automatically calculate the net economic gain or loss of two alternative scenarios: (1) preg-checking and culling non-pregnant cows in the fall and (2) preg-checking in the fall and feeding cull cows as a separate group. Both alternatives are compared to the option of not preg-checking and overwintering open cows before culling them in the spring. Producers can use this model to help make a sound economic decision about whether or not to preg-check given their particular management practices.

Features of the model include:

1) A basic version in which producers only have to enter six parameters (herd size, type of management system, the months of preg-checking and calving, the current fall month and current market price of cull cows). This basic model was designed to be a simple, easy-to-use tool that can provide a reliable estimate of the net benefit of preg-checking with as little producer data requirements as possible.
2) An advanced version in which producers can enter herd-specific information on their cost of production, average daily gain, length of winter feeding period, herd open rate, and veterinary cost. The advanced model provides a more accurate estimate of the net benefit of preg-checking for a particular herd.
3) The model was built with data specific to Western Canada. All data used in the model, including cost of production, winter feeding period, average daily gain, fall cow weight,

market price, herd open rate, and veterinary cost come from studies conducted in Western Canada.

4) Forecasts of cull cow market price based on seasonality. The model accounts for monthly variation in cull cow price using Alberta market data from 2005 - 2014.
5) Primary data for the cost of preg-checking from a survey of 29 veterinary clinics in Alberta and Saskatchewan.
6) Full transparency. Producers are welcome to observe how all the parameters in the model are affected by changing their management variables. This is an extremely valuable management tool as it allows producers to run their own "what if?" scenarios regarding everything from cattle market price to herd open rate.

Three main factors drive the model and determine the economics of pregnancy-checking: overwintering cost, the veterinary cost of preg-checking and the value of the cow. While previous debate on the economics of preg-checking focused largely on minimizing overwintering costs, the model shows that with the current high market price of cattle, the value of the cow is actually the most important factor. Non-pregnant cows diagnosed via preg-checking and fed as a separate group therefore present a unique economic opportunity for cow-calf producers. This economic model can help re-frame the debate of preg-checking from one that centered on cutting costs to one that focuses on maximizing cow value.

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1.0 Introduction

This project involved building an economic model for Canfax Research Services (CRS) to determine the cost-benefit of pregnancy testing ("preg-checking") for cow-calf operations in western Canada. Reproduction is the most significant component of cow production, and a clear understanding of how management and usage of veterinary services can impact a producer's cost and financial efficiency is essential. A cow-calf operation is defined as a farm or ranch where a permanent herd of cattle are managed; income is largely generated by the sale of each year's calf crop and thus pregnancy rate has a direct and major impact on an operation's finances and cash flow.

Cow-calf producers generally have three options for non-pregnant cattle. The first option is to preg-check in the fall and cull all non-pregnant ("open" or "cull") cows immediately. The general reasoning behind this decision is that the producer has no need (or capacity) to overwinter non-pregnant cattle and does not want to absorb the cost of overwintering open cows. The second option is to preg-check in the fall, separate non-pregnant cull cows from pregnant cows, feed the two groups separately and market the cull cows at a later date. By feeding the groups separately, the producer can place the cull cows on a high-energy ration so they gain additional weight and fat to increase their value before marketing them. The final option is to not preg-check in the fall, feed all cows through the winter (incurring feed and overhead costs) and cull the non-pregnant cows in the spring. Historically, the market price for cattle has been higher in the spring than in the fall, raising the question of whether or not there is a financial benefit for producers to preg-check.

The first objective of this project was to create a cost-benefit model for pregnancy-checking based on several important factors - cattle market price, veterinary service cost, type of producer management system, herd open (non-pregnancy) rate, and overwintering costs. The producer generally cannot influence the market price of feed and cattle, nor veterinary service costs. However, the producer can decide when to sell their cattle and has influence on the type of feed used and the herd open rate (based on management practices).

The second objective of this project was to use the economic model to develop an interactive tool for producers at the farm-level to determine if it is financially beneficial to preg-check given their circumstances. The tool allows producers to input the current market price of cull cows, the number of cows in their herd, the type of management system they use, the month they plan to market cull cows, and the anticipated month of calving. The model will calculate the net benefit of preg-checking and selling non-pregnant cows in the fall compared to feeding all cows through the winter and culling open cows in the spring. The producer also has the option to enter more specific data including the open rate of the herd, estimated feed and yardage costs, length of the winter feeding period, average daily gain of cattle, and veterinary preg-checking costs to get a more accurate calculation for their herd. In addition, the producer can choose to enter additional management data to determine if preg-checking and feeding cull cows separately is a more financially beneficial option.

2.0 Background

Canfax Research Services' (CRS) purpose is to provide the Canadian beef industry with accurate data, market information and economic analyses of important industry issues. The Canadian Cattlemen's Association, provincial organizations, marketing & research organizations, governments, and other industry stakeholders use the information and analyses generated by CRS to assist in policy and business plan development as well as performance measurement evaluation.

CRS has been contracted by the Beef Cattle Research Council (BCRC) to develop research evaluation and performance measures. This project will contribute to the Animal Health and Welfare Priority Area Review that is currently ongoing.

Providing decision making tools to producers is a key part of the BCRC technology transfer plan. Decision-making tools highlight alternatives available to producers and provide the potential cost-benefit of adopting new or different options. These tools have application not only at the farm level but also in research to determine where gaps exist that need to be addressed by the industry. This information is made available at www.beefresearch.ca.

This project was designed to help elucidate the economic impact of preg-checking for producers. It is well-known that reproductive disease is extremely costly to the beef industry. A review by Bellows and Bellows (2002) found that reproductive failure in cattle costs the American beef industry between $441-502 million per year. According to the 2015 Western Canadian Cow-Calf Survey, open rates were 7% in cows and 10% in heifers (Western Beef Development Centre, 2015). Many factors can lead to reproductive failure, including bull infertility, cow nutrition, and other diseases (Hendricks & Campbell, 2015). However, twenty-five percent of reproductive

failures in Western Canadian herds go undiagnosed; thus the relative impact of each factor is not completely understood (Hendricks & Campbell, 2015).

Bovine Viral Diarrhea (BVD) and Infectious Bovine Rhinotracheitis (IBR) are two common infectious diseases that cause reproductive loss in cattle. BVD is maintained in herds primarily via persistently infected (PI) calves. Taylor, et al., (1995) found that the prevalence of PI calves in western Canadian feedlots was less than 0.1%. However, in a study of almost 30,000 cattle in over 200 herds across Western Canada, Waldner (2014) found that cows not vaccinated for BVD and IBR were 3.5 times more likely to abort than vaccinated cows when bred on community pasture. *Leptospira hardjo,* another infectious agent that is known to cause reproductive failure, had very low prevalence in Western Canada, with less than 2% of cows testing positive (Van De Weyer, Hendrick, Leigh, & Waldner, 2011). In terms of nutrition, Waldner, et al., (2010) found that lower copper levels in Western Canada increased the risk of open cattle and recommended that herds in areas with known copper deficiency institute a supplementation program.

Large-scale economic studies of non-pregnancy in cow-calf operations have been limited due to the many different management strategies employed by producers and the large quantity of epidemiological and economic data required. As discussed previously, there has been a significant amount of research conducted to determine reproductive disease prevalence, open rates and control strategies; however, this research has not yet linked an economic cost to cow-calf producers (Waldner C. , 2014; Weyer, Hendrick, Rosengren, & Waldner, 2011). However, bridging the gap between the epidemiology of reproductive failure and the economic cost to producers is essential for effective, cost-saving control strategies to be employed. In addition to its economic impact, preg-checking, as a control strategy, can determine the reproductive health of a herd and help direct the diagnosis of disease and nutritional deficiencies. For example, preg-

checking can help differentiate between conception failure and abortion loss, and can therefore direct where to focus control strategies (Waldner C. , 2014).

However, despite the plethora of evidence in support of preg-checking, both from an economic and herd health perspective, the 2015 Western Canadian Cow-Calf survey indicated that only 60% of producers choose to utilize preg-checking as part of their management strategy. While this represents a 10% increase from the 1997/98 Alberta Cow-Calf Survey, the question arises of why 40% of producers still choose not to preg-check their cows, and whether their reluctance is based on an economic decision. Do producers choose not to preg-check because the market value of a cull cow has been historically higher in the spring? If this is the case, they may perceive preg-checking as an unnecessary expense. This project will provide clarity about the economics of preg-checking so that producers can be confident that their herd management decisions are financially beneficial.

The focus of this project's deliverable is to provide a comprehensive economic model based on current cattle market price to enable producers to make an economically sound decision of whether or not to preg-check their cows.

3.0 Methodology

The project was divided into phases with clear deliverables and timelines. During the project timeline, two conference calls were conducted between Elad, Alex, Brenna Grant (CanFax), and Murray Jelinski (WCVM). The first conference call was during the preliminary phases of developing this project on March 2, 2015. The second call was to follow-up to the development of the economic model on June 18, 2015 to gather ideas for framing the model for cow-calf producers. Email correspondence was vital during all of the project phases for idea sharing and feedback on deliverables.

The following 7 phases were followed to complete this project:

- Phase 1: Environmental Analysis through Primary Research
    - A survey was developed and distributed following ethics approval.
        - A veterinary clinic survey (Appendix 3) was distributed to large animal and food animal veterinary practitioners in western Canada to obtain data on cost of veterinary pregnancy-checking services for cow-calf producers, as well as the average client herd size.
            - 173 clinics were chosen from the Saskatchewan Veterinary Medical Association (SVMA) and Alberta Veterinary Medical Association (ABVMA) lists of registered clinics based on type of practice.
            - A paper copy of the survey was sent to veterinary clinics, along with a memo explaining the survey's purpose and postage-paid return envelopes for survey responses.

    - An electronic form of the survey was developed using SurveyMonkey and the link provided in the memo.
    - Response rate was expected to be less than 50%.

- Phase 2: Environmental Analysis through Secondary Research
    - Secondary research was gathered to assess the costs associated with non-pregnancy, market value of cattle, and non-pregnancy rates. A literature review was conducted to gain information on the costs associated with non-pregnancy in cattle including preg-checking, culling, or keeping a non-pregnant cow through the winter. Weekly Alberta D1,2 cow market prices from 2005 - 2014 were examined to determine if there were any trends or monthly differences in price. The following outlines the sources of secondary research:
        - Published research and data available through the University of Saskatchewan's library database and the Western Beef Development Centre's website
        - Cattle market data was obtained from CanFax
- Phase 3: Analysis of Survey Results and Market Data
    - A spreadsheet was created with the results of the veterinary clinic survey to determine the average cost of preg-checking by veterinarians in Alberta and Saskatchewan.
        - Average cost was analyzed on a per-head basis.
    - Market data was analyzed to determine the average cattle market prices for different times of the year.

- Phase 4: Developed parameters for the economic model to determine the net gain or loss to cow-calf producers with regards to percentage of non-pregnant cows, veterinary service costs, production costs, average daily gain, market value at different times of the year, and length of the over-wintering period.
    - Two sets of parameters were developed:
        - Basic Model – Cow-calf producers would have to input minimal custom data. In this model, most values would be automatically calculated for the producer using data collected from primary and secondary research in the above phases.
        - Advanced Model – Cow-calf producers would be able to input custom data for more accurate results.
- Phase 5: Developed the parameters for an interactive visual chart that producers can use for their cow-calf herds. The chart was developed using Excel so that many different values and formulas could be linked depending whether the producer chose to use the basic or advanced economic model. Helpful "hints" and explanations were included in the chart to minimize confusion when producers input their herd information. The final design for the BCRC website will be determined by CanFax and the BCRC.

Synopsis

The following report provides an overview of the economic model including key features of the model (basic and advanced versions), the main drivers of the model, how the data can be applied to different production situations, and how the model will help re-frame the debate on pregnancy checking. One of the benefits of the model is the full transparency provided to producers with respect to changing variables and results. Essentially, producers have the ability to conduct their

own sensitivity and scenario analyses to determine how changing different aspects of their production system can affect their bottom line. This will lead to a better understanding of the economics that affect the value of each cow, and thus help to re-frame the debate on pregnancy checking.

4.0 Analysis of Results

The economic model

Each year, a producer is faced with the decision of whether or not to pregnancy-check; this decision can have a significant impact on the producer's bottom line. There are many factors that must be considered in the decision to pregnancy-check including economics and herd fertility. The value of a cow in a cow-calf operation is dependent on many parameters, some of which can be manipulated by the producer including the type of production system used or the length of the winter feeding period. Conversely, cow-calf producers cannot control some variables, namely the market price for cattle or feed. This economic model attempts to accurately calculate the net gain or loss in cow value based on all these parameters. Producers will then be able to compare how a cow's value changes depending on whether or not they preg-check.

Secondary research determined the average costs associated with most of the variables and producers can alter these costs in the model, if they are known. Similarly, the veterinary cost of pregnancy-checking is provided in the model based on primary research, though producers can alter this value as well if they know their own veterinary costs. The unknown cull-cow market prices are projected using the current price and a seasonal model of 10-year historical data.

The economic model and its legend are presented in Appendices 1 and 2, respectively. An electronic Excel version of the model has been included with this report. There will be three sections for producers to enter data:

1) Section 1 – Basic Model

Producers will be asked to enter six pieces of information for their herd: herd size, type of management system, the month they plan to preg-check, the anticipated calving month, and the current fall month and market price. The model will then use Western Canadian averages for cost of production, fall weight, average daily gain (ADG) over winter, length of winter feeding period, herd open rate, and veterinary cost to calculate the net gain or loss of preg-checking. The basic model was designed to be a simple, easy-to-use tool that can provide reliable estimates with as little producer data requirements as possible.

2) Section 2 – Optional advanced model for custom herd management data

Producers will also have the option to enter custom data for their herd in the advanced model. By entering their own cost of production, ADG, length of winter feeding period, herd open rate, and veterinary cost the model can more accurately calculate the net gain or loss of preg-checking for their specific herd.

3) Section 3 – Cull Cows Fed as Separate Group

In the third section of the model producers will have the option to enter parameters for feeding cull cows as a separate group. By entering feed and overhead cost, the number of days they plan to feed, and the ADG they expect to attain for the group, the model will calculated the expected gain or loss of preg-checking in the fall and feeding cull cows as a separate group.

Main drivers in economic model

The economic model calculates the gains and costs for a producer to preg-check their cows under various scenarios. A summary of the gains and costs calculated in the model is presented in Table 1.

***Table 1**. Summary of gains and costs in the two alternative options for preg-checking. In the model, both alternatives are compared to the option of overwintering non-pregnant cattle and culling in the spring (i.e. not preg-checking). The decision with the highest gain/head is deemed the best option from an economic perspective.*

<table>
<tr><th colspan="2">Alternative 1 – preg-check and cull in fall</th><th colspan="2">Alternative 2 – preg-check and feed cull cows as separate group</th></tr>
<tr><td>Economic gain</td><td>Economic cost</td><td>Economic gain</td><td>Economic cost</td></tr>
<tr><td>Overwintering cost of non-pregnant cows</td><td>Vet cost of preg-checking herd</td><td>Overwintering cost of non-pregnant cows</td><td>Supplemental feed cost</td></tr>
<tr><td rowspan="2">Value of non-pregnant cows in the fall (value realized)</td><td rowspan="2">Value of overwintered non-pregnant cows (value forgone)</td><td rowspan="2">Value of fed cull cows at time of sale (value realized)</td><td>Value of overwintered non-pregnant cows (value forgone)</td></tr>
<tr><td>Vet cost of preg-checking herd</td></tr>
</table>

The equation the model uses for alternative 1 is as follows:

Gain/head = [(Overwintering cost + Change in value of cow) x Open rate] – Vet cost

The equation the model uses for alternative 2 is as follows:

Gain/head = [(Overwintering cost + Change in value of cow – Fed cost) x Open rate] – Vet cost

Note that the value calculated is the gain per head for the entire herd, not simply the open cows. The model therefore calculates how much a producer will gain *for every cow in the herd* if they decide to preg-check.

Three main factors drive the model and determine the economics of preg-checking: overwintering cost, the value of the cow, and the veterinary cost of preg-checking. The

veterinary cost is fairly straight-forward as it is the total cost of preg-checking the herd; the other two drivers are explained below in detail.

1) Overwintering Cost

The primary economic gain of preg-checking and culling cows in the fall is that producers avoid incurring the cost of overwintering non-pregnant cows. In western Canada the average cost of production for one cow in the winter ranges from $0.98 to $1.78/day depending on the management system used (see Appendix 3). Over an average winter period of 160 days, producers will save between $156.80 - $240.80 per non-pregnant cow identified and culled; producers who overwinter longer will gain even more.

However, total overwintering costs are largely determined by the cost of feed. In the three studies used to build the cost of production averages for western Canada, feed costs accounted for 59.5% of total overwintering cost (Appendix 3). It is important to note that feed costs are highly variable and difficult to forecast, so producers may enter their own cost of production into the model as prices change to more accurately determine how much they can save from culling open cows in the fall.

Simply put, the higher a producer's feed and overwintering costs the more the model favours preg-checking and culling cows in the fall.

2) Value of the Cow

The value of the cow is determined by two main factors – market price and weight of the cow – and both will vary depending on the time of culling. If an open cow is culled in the fall, the producer gains the value of the cow in the fall, at fall market price and fall weight. If the

producer does not preg-check and instead culls open cows after overwintering them, they gain the value of the cow in the spring, at spring market price and spring weight. It is important to remember that both market price and weight of the cow will be different between the fall and the spring, as market prices fluctuate seasonally (Figure 2) and cull cows gain weight over the winter. When making an economic decision about when to cull, the difference in value of the cow in the spring and fall must be considered, rather than simply the market price.

The average daily gain (ADG) of cull cows over the winter feeding period has a significant impact on the cow's spring value; higher weight gains over the winter result in higher spring values than low weight gains, regardless of the market price. Additionally, ADG varies with management system (Table 2). However, not every producer will realize the same ADG using the same management system due to other factors including cattle genetics or environmental conditions (e.g. harsh winter versus mild winter). The average ADG for three of the most common management systems in Western Canada is summarized in Table 2.

***Table 2**: Average ADG for Western Canada management systems*.

Type of Management System	ADG (lbs/day)
Drylot mixed hay	1.44
Swathed barley grazing	0.58
Bale grazing	0.88

In order to demonstrate the utility of the model, a sensitivity analysis was performed to determine how ADG affects the gain per head of preg-checking and culling non-pregnant cows in the fall under the three management systems (Figure 1). Only ADG was changed, and all other

variables were kept constant including the month of pregnancy testing (October), the month for calving (March), length of the winter feeding period (160 days), herd open rate (7.7%), and veterinary cost to pregnancy check ($4.37). The average Alberta market price for D1,D2 cows from September of 2014 (CAD$1.23/lb) was applied to the model.

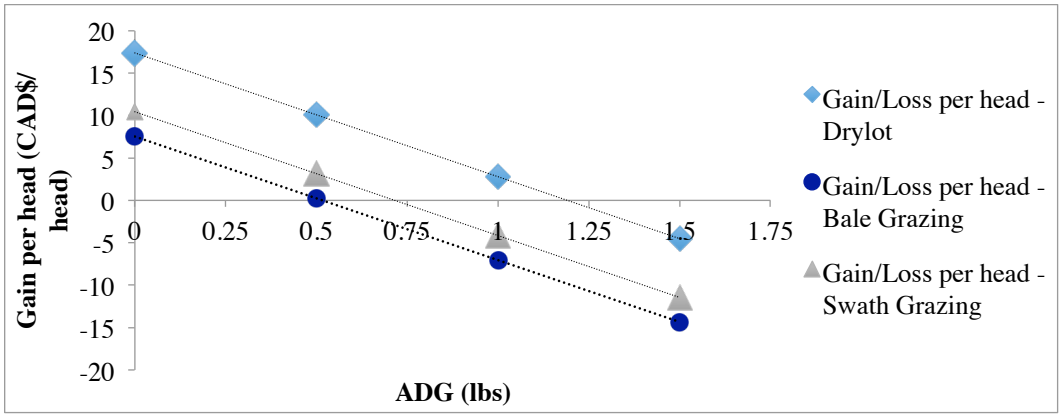

Figure 1*. How the Average Daily Gain (ADG) affects the gain per head for three management systems: Drylot, Bale Grazing and Swath Grazing*

Any gain per head above $0 signifies that the producer would see a greater benefit by culling and marketing open cows immediately after preg-checking rather than waiting to market them in the spring. Conversely, when the lines go below $0, the model favours overwintering open cows and selling them at calving time. Thus, for the drylot management system, any ADG below approximately 1.2 lbs./day supports the option to cull and market open cows immediately after preg-checking in October, but if the ADG is above 1.2 lbs./day the model favours keeping open cows through the winter and marketing them in March.

To summarize, with high cull cow prices and a high ADG, the model favours overwintering cows until the following spring over culling in the fall as every pound of gain is more valuable.

While the market price for cattle is difficult to forecast, the model makes a conservative estimate based on monthly variation using weekly Alberta price averages from 2005 – 2014 (Figure 2). For example, if the price for D1,2 cows in September 2015 is $1.50/lbs., the model predicts that the price will be $1.18/lbs. in January 2016 and $1.59 the following August based on seasonality differences over the last ten years. The lowest price over the last ten years has been in the month of January while the highest market price has been in August.

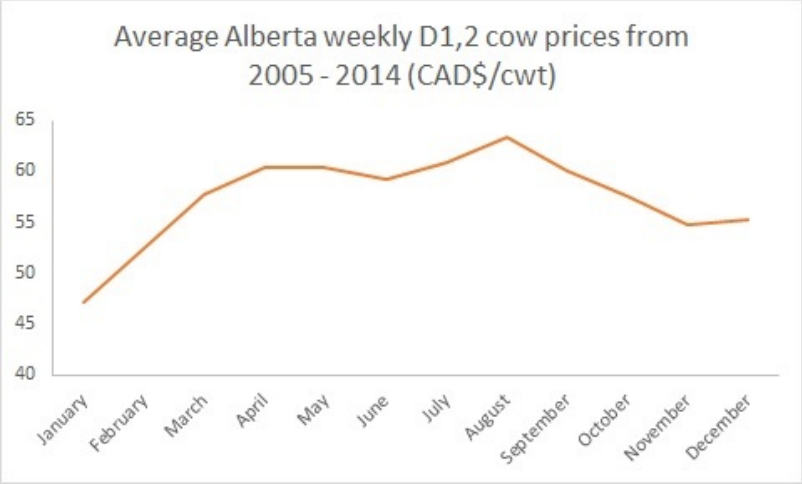

Figure 2. *Alberta weekly D1,2 cow prices averaged by month from 2005 – 2014.*

To illustrate the role that the market price of cattle plays in the decision to pregnancy-check, a sensitivity analysis was performed (Figure 3). In this example, the drylot management system was selected, with the western Canadian averages of winter feeding period, herd open rate and veterinary costs.

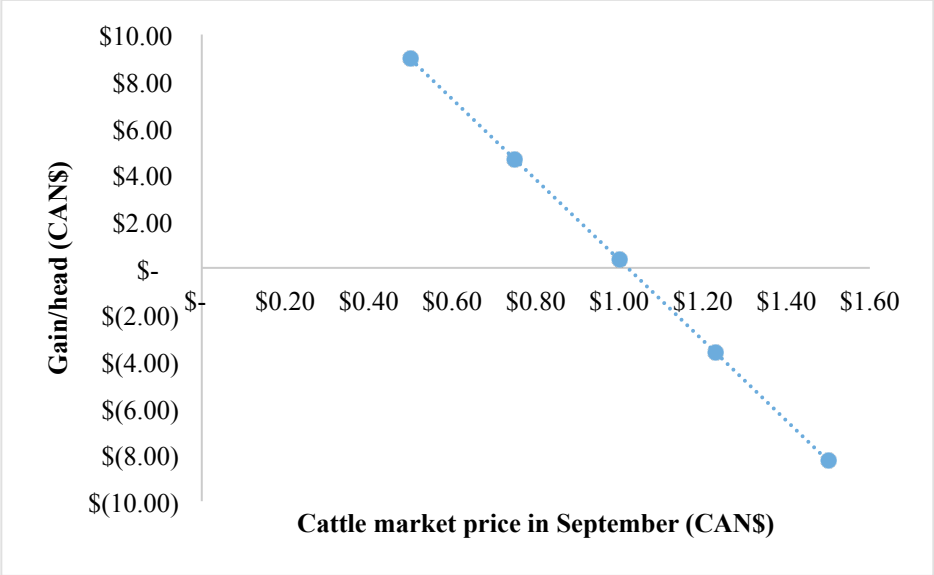

Figure 3. *How the changes in September cattle market price affects the gain per head of cows that are preg-checked in the fall and culled immediately.*

The sensitivity analysis shows that for this management system there is a threshold market price of $1.02/lbs. that determines if it is beneficial to preg-check and cull in the fall. Any price below $1.02/lbs. favours the decision to preg-check and cull immediately, and any price above $1.02/lbs. favours the decision to overwinter cattle, as the weight a cull cow gains over the winter is more valuable at $1.02/lbs. than the cost of overwintering. Producers can use this model to easily perform these types of analyses to help management decisions; the producer simply has to fill in their data in the model and find the threshold market price (or any other variable) by trial-and-error at which the gain from pregnancy-checking is 0. They can then make an informed decision about whether to preg-check based on the threshold value of any number of factors – market price, herd open rate, ADG or cost of production.

Scenario Analysis

In most scenarios, the model shows that the greatest economic benefit for a producer is to preg-check their herd and separate the non-pregnant cows to feed and market at a later date (Figure 4). The only case when separate feeding of cull cows is a less favorable option is when the overhead costs of separately fed cows is very high and the number of days on feed is low – placing the market date in January when cow prices have been historically the lowest of any month during the year. Increasing the veterinary cost of pregnancy checking does not significantly affect either alternative unless the net gain or loss is very close to zero. See Table 3 for a list of the variables that were changed for each scenario.

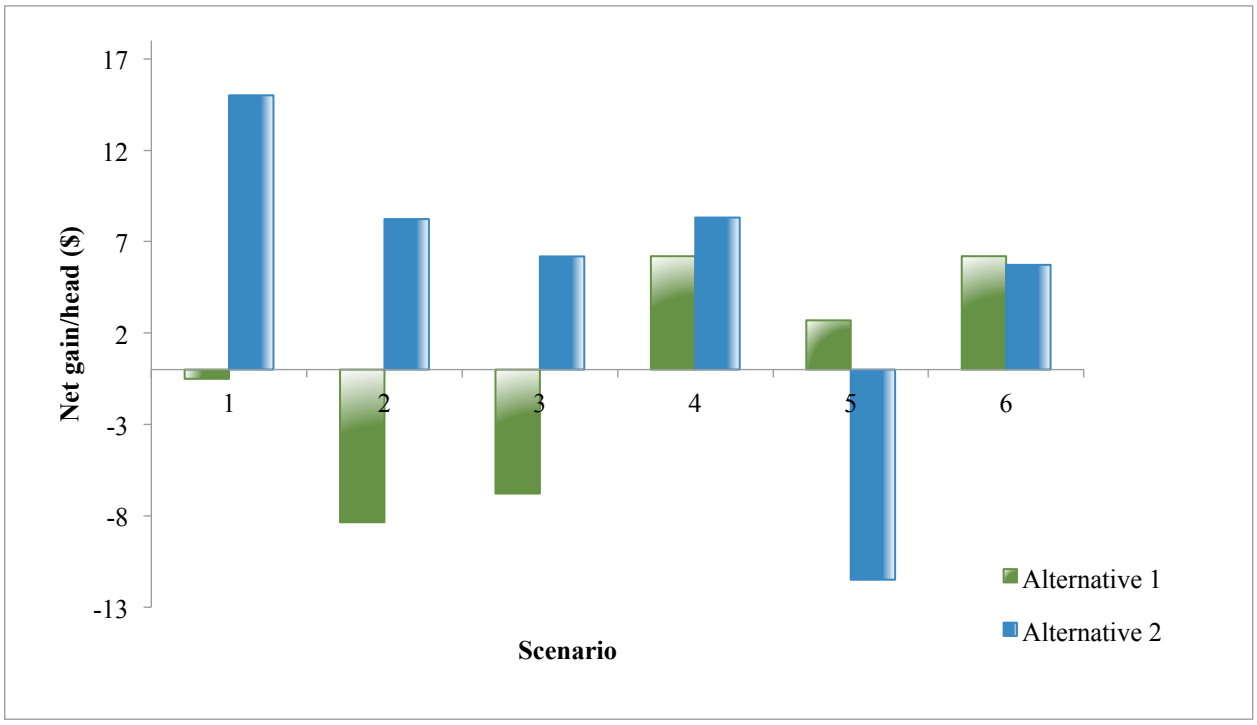

Figure 4. *Scenario analysis of the net gain/head ($) for Alternative 1 (preg-check and cull in fall) and Alternative 2 (preg-check and feed cull cows separately). In most scenarios feeding cull cows separately provides the greatest economic benefit. See Table 3 for the variables used in the scenario analysis.*

Table 3. *Six scenarios showing how changing variables in the advanced economic model impact Alternatives 1 and 2.*

Scenario #	**1**	**2**	**3**	**4**	**5**	**6**
Herd size	100	100	100	100	100	100
Management System	E	E	E	E	E	E
Expected month of preg-checking	B	B	B	B	B	B
Anticipated calving month	B	B	B	B	B	B
Current fall cull-cow market price (CAN$/lbs)	1.23	1.50	1.50	1.00	1.23	1.00
Enter the month for the price above	A	A	A	A	A	A
Cost of production ($/cow/day)	1.50	1.15	1.40	1.80	1.75	1.80
Length of winter feeding period (days)	160.00	160.00	160.00	160.00	160.00	160.00
ADG (lbs/day)	1.00	1.00	1.00	1.00	1.00	1.00
Vet cost for preg checking one cow	4.37	4.37	6.00	4.37	4.37	4.37
Herd open rate	0.08	0.08	0.08	0.08	0.08	0.08
Estimated number of cull cows	8.00	8.00	8.00	8.00	8.00	8.00
Month cull cows marketed	March	March	March	March	January	March
Estimated cull-cow price at marketing ($)	1.18	1.44	1.44	0.96	0.97	0.96
Feed and overhead cost ($/cow/day)	1.00	0.85	1.75	1.75	0.80	1.50
Number of days on feed	140.00	140.00	140.00	140.00	90.00	140.00
ADG (lbs/day)	2.00	1.60	2.00	2.00	2.00	1.50
Alternative 1	**-$0.51**	**-$8.35**	**-$6.78**	**$6.20**	**$2.69**	**$6.20**
Alternative 2	**$15.00**	**$8.23**	**$6.19**	**$8.32**	**-$11.50**	**$5.73**

Re-framing the debate on preg-checking

Perhaps the greatest strength of the economic model is that it can help re-frame the debate of preg-checking in cattle. Previous debate about the cost-benefit of preg-checking centered around two factors: the veterinary cost of preg-checking and the feed cost of overwintering an open cow (Bridges, Lake, Lamenager, & Claeys; Radke, 2014; Richmond). Those in favour of preg-checking argued that from an economic perspective feed costs vastly outweighed the cost to preg-check, thus there was a large economic benefit of preg-checking and culling all non-pregnant cows immediately. However, the economic model we present here shows that cow

value is often a more important factor in the economics of preg-checking than either overwintering or veterinary costs. High cattle prices present producers with an economic opportunity if they can identify and feed non-pregnant cows to increase their value. Conversely, should cull cow prices drop to pre-2012 levels (below $0.75/lbs.), many scenarios indicate that preg-checking and culling in the fall is a better option as the cost of overwintering begins to outweigh the benefit of selling heavier cull cows in the spring.

While producers can use this model to determine the economic viability of preg-checking their herd, the model can perhaps provide greater value as a management tool that can be used to guide production practices. Producers can determine for themselves which alternatives have the greatest potential economic benefit for their herd given different market factors and management practices.

Veterinary Clinic Survey Results

In total, 173 surveys were mailed to veterinary clinics throughout Alberta and Saskatchewan (Appendix 4). We received 8 responses through the online survey tool and 24 responses by mail for a total of 32, and a response rate of 18.5%. 29 responses were from Alberta and 3 were from Saskatchewan. Three clinics in Alberta indicated that they did not have cow-calf clients and could not be used for the study; therefore 29 surveys were used to determine the average cost of pregnancy checking per head.

Based on the responses, the average cost of pregnancy checking in western Canada is $4.37/head. Regionally, there was a slight difference between the cost in Alberta ($4.33/head) and Saskatchewan ($4.58/head); though the sample size from Saskatchewan was low. A consolidated breakdown of the survey responses can be seen in Appendix 5.

Because of the variation in cost-structure used by veterinary clinics, we had to employ a variety of assumptions to determine the average cost per head. The assumptions were as follows:

1. Number of cows pregnancy checked per hour: we assumed a pregnancy checking rate of 75 cows per hour (Jelinski & Erickson, 2015).
2. Clinics that provided more than one method of charging clients: rates for clinics that used an hourly rate and per head rate were calculated using the assumed rate of 75 cows/hour with the additional per head rate indicated by the clinic.
3. When a clinic charged differently per head depending on the number of cows in a herd, we were able to determine the cost for their average client using the breakdown of herd sizes that the clinic provided. However, in some instances, the clinic parameters for herd size were not the same as the parameters in the survey questions. Therefore, we had to assume an even distribution of herd sizes over their parameters in order to calculate their charge/head.
    a. For example: One clinic charged the following per head, based on herd size:
        i. $4.50 if <50 head, $3.75 if 50-100 head, and $3.25 if >100 head

    As per the survey questions, the distribution of their client herds were:

        i. 60 clients with <50 head, 300 clients with 50-200 head, and 60 clients with >200 head

    Using these assumptions, we assigned 100 of the 300 clients to the 50-100 group and the remaining 200 to the >100 group to calculate the average cost for a client at their clinic.

Since the cost of preg-checking was calculated on a per head basis, it can have a significant impact on the gain/head in the economic model. In some cases, higher preg-checking prices make the option to not preg-check appear more favourable and a producer may think that Alternative 1 (preg-checking and culling immediately) is not valuable. However, the veterinary cost impact is much less significant on Alternative 2, and due to the much larger gain in Alternative 2 compared to the other two options, pregnancy checking is still very beneficial in most scenarios because it allows a producer to separate their non-pregnant cows in the fall, increase their ADG on a cheaper management system, and gain a higher profit at market in the spring.

5.0 Conclusion and Recommendations

There are many factors that influence the financial status of a cow-calf operation. Producers are faced with many decisions including the type of management system to use and how to manage non-pregnant cows. Traditionally, producers have debated the cost-benefit of pregnancy checking. Those in favour reasoned that feed costs vastly outweigh the cost of pregnancy checking, and therefore an economic benefit existed to pregnancy check and cull all non-pregnant cows immediately. The contrary argument stated that producers might forego the cost of pregnancy-checking altogether by selling their non-pregnant cows at calving time when market prices have historically been higher than the fall. However, the economic model that we have developed illustrates that there is another net benefit of pregnancy checking and that non-pregnant cows diagnosed via pregnancy checking may present an economic opportunity for cow-calf producers if they can feed them separately through the winter for marketing in the spring.

The economic model is affected by overwintering costs (production costs per day per cow), value of the cow (affected by weight and market price) and veterinary pregnancy checking costs (averaging at $4.37/cow in western Canada). Currently, cattle market prices are at an all-time high, which favours the alternative to pregnancy check and separately feed non-pregnant cows through the winter. Producers can further benefit in this alternative by using a less expensive management system, improving ADG, and strategically determining the number of winter feeding days in order to market the cows in the most favourable spring month.

One of the weaknesses of the model is the inability to account for the upward trend in market price over the last few years. Over a 52 week period from April 2014-March 2015, D1,2 cattle market prices increased at a rate of 38.5%. Although our model uses percent changes to estimate seasonal differences in prices, it assumes a price growth rate of 0% from September until the following summer. It is likely that at some point in the future market prices will level off, but it is unknown when this will happen or to what degree prices will change in the coming years. To overcome this weakness, cattle prices would have to be estimated by forecasting method such as a moving average on a weekly basis and then incorporated into the current model. However, this may overestimate future cattle market prices, as it is unlikely that the market will indefinitely increase at the current rate. Therefore, our model provides a more conservative estimate of future cattle prices and helps protect producers from a potential decrease in market price.

This model will be a valuable tool for cow-calf producers to make an economically sound decision of whether or not to pregnancy check their cows. Producers will benefit from being able to manipulate the variables within the model to determine the most economically viable management practices for their herd, which could impact the general practices in the industry. We are confident that the results calculated by the model fit well with the objectives of CRS and

the BCRC to provide important, accurate and relevant decision-making tools to cow-calf producers and other stakeholders in the beef industry.

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Appendix 1 - Image of the economic model that will be provided to CRS and developed into a website tool for producers.

PART A - PRODUCER INFORMATION

Section 1 - Basic Model

Factors		Additional Information
Herd size	100	Enter number of cows and first-calf heifers
Management System	A	A = drylot; B = swathed barley; C = bale grazing; D = standing corn grazing; E = option to enter custom data
Expected month of preg-checking	B	A = September; B = October; C = November
Anticipated calving month	B	A = February; B = March; C = April; D = May
Current fall cull-cow market price (CAN$/lbs)	1.23	Enter the current fall market price for cull cows in Canadian dollars per pound
Enter the month for the price above	A	A = September; B = October; C = November

Section 2 - Optional advanced model for custom herd management data

Factors		Additional Information
Cost of production ($/cow/day)	$1.78	Enter the cost of production for overwintering per day for each cow, based on your production system (including feed and overhead costs)
Length of winter feeding period (days)	160	
ADG (lbs/day)	1.44	Average Daily Gain, per cow
Vet cost for preg checking one cow	$4.37	Enter the cost charged by your veterinarian to preg-check one cow
Herd open rate	7.7%	Percentage of herd that is open in the fall

Section 3 - Cull Cows Fed as Separate Group

Factors		Additional Information
Estimated number of cull cows	8	Calculated from the herd size and herd open rate (average of 7.7% if not specified)
Month cull cows marketed	March	Calculated using month preg checked and number of day on feed
Estimated cull-cow price at marketing ($)	1.18	Estimated based on the month from above
Feed and overhead cost ($/cow/day)	1.00	**(Leave blank if not using section 3) Note:** This may be different than your production cost for overwintering.
Number of days on feed	140	Total days that cull cows are separated and fed until marketed (may enter between 1 and 350 days)
ADG (lbs/day)	2.00	Average Daily Gain per head you expect to attain for the group

Section 4 - Management Factors

Cost of production ($/day/head)	Winter feeding period (days)	ADG (lbs)	Total gain over winter (lbs/cow)
1.78	160	1.44	230.4

Section 5 - Cull Cow Value

Value of cow in October	Value of cow in March	Difference
$1,534.12	$1,809.15	$275.03

Section 5b - Cull Cow Value when fed separate

Value of separately fed Cow in March	Value of cow in March	Difference
$1,867.99	$1,809.15	$58.84

PART B - ECONOMIC MODEL RESULTS

Do not preg-check (cull in spring)		Alternative 1 - Preg-check and cull immediately		Alternative 2 - Preg-check and feed cull cows separate	
$0.00	Gain/head	-$3.62	Gain/head	$11.31	Gain/head
$0.00	Gain for herd	-$361.77	Gain for herd	$1,131.07	Gain for herd

PART C - ECONOMIC MODEL DATA

Section 1 - Management Factors

Management System	Cost of production ($/cow/day)	Winter feeding period (days)	ADG (lbs/day)	Total gain over winter (lbs)	Vet cost ($)	Average herd open rate (%)
Drylot	1.78	160	1.44	230.4	4.37	7.7%
Swathed barley grazing	1.22		0.58	92.4		
Bale grazing	0.98		0.88	140.8		
Standing corn grazing	1.78		1.17	187.2		
Producer custom data (based on entries from Part A, Section 2)	1.78	160	1.44	230.4	4.37	7.7%

Section 2 - Market Factors

Month	Historic average price (CAN$/lbs)	Projected price based on known September price (CAN$/lbs)	Projected price based on known October price (CAN$/lbs)	Projected price based on known November price (CAN$/lbs)	Average Live Weight (lbs)	Value
September	0.6002	1.2300	1.2802	1.3470	1298	$1,596.68
October	0.5767	1.1818	1.2300	1.2942		$1,534.12
November	0.5481	1.1232	1.1690	1.2300		$1,458.01
December	0.5535	1.1343	1.1806	1.2422		
January	0.4717	0.9666	1.0060	1.0585		
February	0.5241	1.0741	1.1179	1.1762	1528	$1,641.60
March	0.5776	1.1837	1.2320	1.2963		$1,809.15
April	0.6042	1.2383	1.2888	1.3561		$1,892.67
May	0.6043	1.2384	1.2889	1.3561		$1,892.70
June	0.5920	1.2132	1.2626	1.3286		
July	0.6090	1.2481	1.2990	1.3669		
August	0.6346	1.3005	1.3535	1.4242		

Section 3 - Veterinary Cost and Open Rate

Average vet cost of preg check/cow ($)	Average herd open rate
4.37	7.7%

Section 4 - Percent Changes in Cattle Price

Month	Monthly Averages from 2005-2014 (CAN$/cwt)	Percent change based on September market price	Percent change based on October market price	Percent change based on November market price
September	$60.02	0.00%	4.08%	9.51%
October	$57.67	-3.92%	0.00%	5.22%
November	$54.81	-8.68%	-4.96%	0.00%
December	$55.35	-7.78%	-4.02%	0.99%
January	$47.17	-21.41%	-18.21%	-13.94%
February	$52.41	-12.68%	-9.12%	-4.37%
March	$57.76	-3.77%	0.16%	5.39%
April	$60.42	0.68%	4.78%	10.25%
May	$60.43	0.68%	4.78%	10.25%
June	$59.20	-1.37%	2.65%	8.01%
July	$60.90	1.48%	5.61%	11.13%
August	$63.46	5.73%	10.04%	15.79%

Section 5 - Cull Cow Separate Group Data

Weight of cull cow after feed	Day cull cow was separated	Day cull cow was marketed
1578	288	428

Appendix 2 – Legend for economic model

Part A – Producer Information

Section 1 – Simple Model with Average Herd Management Data

*(*Note: "Basic Model" and "Simple Model" are used synonymously in this legend)*

Herd Size	The number of cows and first-calf heifers (all breeding females).
Management system	Producers will be able to choose between four management systems for the simple model – (A) drylot – mixed hay, (B) swathed barley grazing, (C) barely bale grazing and (D) standing corn grazing. These management systems were chosen because they are commonly used in western Canada and full data was available for their cost of production and average daily gain over winter. This data is used to calculate cost of production, average daily gain and total gain/head over winter in Part A, Section 4. Producers will also have the option to select a custom management system (E) in the advanced model. In this option, producers enter their own cost of production; length of winter feeding period, average daily gain, veterinary cost for pregnancy checking and herd open rate in Part A, Section 2.
Expected month of pregnancy checking	Producers can choose to enter (A) September, (B) October or (C) November. These months were chosen as options because they are the most common for pregnancy checking, as most cows are bred in the summer months and calve in the spring. It is assumed that the month of pregnancy checking is also the month that they will be marketed in the "preg check and cull" option.

Anticipated calving month	Producers can choose (A) February, (B) March, (C) April or (D) May, as these are the most typical calving months in Western Canada.
Current fall cull-cow market price	Enter the current market price for D1,2 cull cows in Canadian dollars per pound. This value, along with the associated month (below) will be used to calculate the expected value of the cow in the spring using a percent-comparison from 10-year monthly averages seen in Part C, Section 2. For simplicity in the basic model, the value of the cow in the spring will correspond to the calving month, as this often the month that non-pregnant cows are also culled and marketed.

Section 2 – Optional Advanced Model with Custom Herd Management Data

(These definitions also apply to the factors in Section 4 – Management Factors, and Part C Section 1 – Management Factors)

In order for producers to utilize the advanced model, they will have to input each of the 5 factors. In situations where they are unsure of a certain factor, average values have been provided in the "Additional Information" column in the model.

Cost of production	In the basic model, it is automatically calculated on a daily per head basis based on the producer's choice of management system. In the advanced model producers that know their daily cost of production per cow may enter that variable instead of the automatic calculation.
Length of winter feeding period	In the advanced model producers may select their own length of winter feeding period. In the basic model, an average winter feeding period of 160 days was applied based on the Western Beef

	Development Centre's 2012 Saskatchewan Cow-Calf Cost of Production survey (Larson, 2013).
Average daily gain	Producers can enter their own ADG in the advanced model in pounds/day. In the basic model, ADG is calculated automatically on a per head basis depending on the producer's choice of management system.
Vet cost for preg checking one cow	The average cost of pregnancy checking was calculated based on the survey responses of 33 veterinary clinics in Alberta and Saskatchewan and found to be $4.37/head. In the advanced model producers can enter their own cost of preg-checking if known. The average cost is automatically applied to the basic model.
Herd open rate	Producers can enter their own herd open rate. The average herd open rate for western Canada was determined in a 2013 study of 405 herds by Waldner and Garcia Guerra. This value (7.7%) is automatically applied in the basic model.

Section 3 – Cull cows fed as separate group

This section is essentially a continuation of the advanced model to determine the economic gain/head for pregnancy checking and feeding non-pregnant cows separately with the intention of selling them after a specified number of days on feed. Producers must enter values in each of the three factors to obtain accurate results.

Estimated number of cull cows	Automatically calculated using the producer's herd size and herd open rate, and is rounded to the nearest whole number.
Month cull cows are marketed	Automatically calculated to produce a month. It is based on the assumption that producers will start to feed their cull cows

	separately immediately following pregnancy checking. Using the number of days on feed (below), and adding those days to the middle of the pregnancy checking month, we can determine which month the cull cows will be marketed.
Estimated cull cow price at marketing	Automatically calculated depending on the anticipated month that the cull cows are marketed and the current market price for D1,2 cows.
Feed and overhead cost	The producer enters the daily cost of production per cull cow fed. This should not be confused with the cost of production in Part A Section 2, as the producer is likely spending a different amount on feed and/or overhead costs for the cull cows that are being fed as a separate group.
Number of days on feed	Producer enters the total number of days that cull cows are separated and fed until marketed. This number is used with ADG to determine the total weight gained over the winter. It also determines which month the cull cows will be marketed, and thus the anticipated market price.
Average daily gain	As in Part A Section 2, producers can enter the average daily gain per cull cow fed separately.

Section 4 – Management Factors

The cost of production, winter feeding period and ADG in this section are discussed in detail above, in Section 2. Each factor is pre-determined for the basic model using averages from research data. In the advanced model, producers enter their own values.

Total gain over the winter	Automatically calculated on a per head basis by multiplying average daily gain multiplied by the winter feeding period.

Section 5 – Cull Cow Value

Value of cow in [month]	This is the first column in this section, and will automatically be labeled with the month of pregnancy checking. This is assuming that cows would be culled immediately following pregnancy checking. The value is calculated based on the average monthly price multiplied by the average weight of a cow in the fall.
Value of cow in [month]	The second column in this section will be labeled with the anticipated month of calving (which is the month of marketing non-pregnant cows). Calculated based on the average monthly price of the producer's selection for anticipated calving month in Section 1 multiplied by the average weight of a cow in the spring (which is itself dependent on the length of the winter feeding period and the average daily gain of the producer's management system).
Difference	The net increase or decrease in cull cow value by marketing her in the spring versus the fall.

Section 5b – Cull cow value when fed separate

Value of the separately fed cow in [month]	This is the value of the cow at the time she would be marketed after being fed separately. It is calculated by multiplying the estimated market price in the month at the end of the feeding period (affected by number of days on feed) and the weight of the cow after being fed separately (affected by the producer's ADG).

Value of cow in [month]	The second column in this section will be automatically labeled with the anticipated month of calving (which is the month of marketing non-pregnant cows that are not separated). It is calculated based on the average monthly price of the producer's selection for anticipated calving month in Section 1 multiplied by the average weight of a cow in the spring (which is dependent on the length of the winter feeding period and the average daily gain of the producer's management system).

Part B – Economic Model Results

The model calculates the cost-benefit of culling (marketing) non-pregnant cows immediately after pregnancy checking or feeding open cows separately after pregnancy checking to market them at a later date. The options to cull immediately or post-feeding are compared to the option that foregoes pregnancy checking altogether and culls non-pregnant cows in the spring, which is set to a baseline level of "zero" gain.

Baseline – Do not preg check (cull in the spring)	This is the baseline option in the model, as the producer does not have to pregnancy check in the fall and keeps all cows together through the winter. All cows would remain under the same management system selected in Part A Section 1, and non-pregnant cows would be marketed in the same month as calving (spring). It is always set to zero in order to facilitate comparison to alternatives 1 and 2.
Alternative 1 – Preg check and cull immediately	This option can be calculated using data from the simple model, but can also be calculated by using data from the advanced model if the producer has selected Management System E and input custom values in Part A Section 2. See below for a breakdown of the parts of the equation. For this alternative, cows would be preg-

	checked and non-pregnant cows culled immediately.
Alternative 2 – Preg check and feed cull cows separate	Information from Part A Section 3 of the advanced model is used to calculate this option. This option becomes useful when the producer has committed to pregnancy checking in the fall and immediately separates non-pregnant cows to feed separately over the winter. The benefit to producers using this option is their ability to manipulate the cost of production (including feed and other management costs), number of days on feed, and ADG of their non-pregnant cows in order to achieve the highest return for their cull cows.

The equations for alternative 1 contain three parts.

Alternative 1 = [(Overwintering cost – Value foregone) * Open rate] – Vet cost

Overwintering cost	This is calculated by taking the daily cost of production and multiplying it by the length of the winter feeding period. It represents the financial gain (or savings) the producer experiences from pregnancy checking and culling open cows in the fall.
Value foregone	The difference between the value of the cow in the spring compared to the value of the cow in the fall represents the *value forgone* by culling in the fall. It represents a financial cost of pregnancy checking.

The difference between overwintering cost (savings) and value forgone is then multiplied by the herd open rate because the gain and cost are both only realized for non-pregnant cows.

Vet cost	The veterinary cost of pregnancy checking one cow is subtracted from the equation as this service is independent of pregnancy status and is a financial cost for every breeding female in the herd.

The total herd savings is then calculated by taking the gain (or loss) per head and multiplying it by the size of the herd entered by the producer in Section 1.

The equation for Alternative 2 contains 4 main parts.

*Alternative 2 = [(Overwintering cost + Value gained – Fed cost) * Open rate] – Vet cost*

Overwintering cost	As with Alternative 1, this is calculated by taking the daily cost of production and multiplying it by the length of the winter feeding period. It represents the financial gain (savings) the producer experiences from pregnancy checking and separating the non-pregnant cows from the pregnant cows. Essentially, this cost is not incurred for the non-pregnant cows because they will be kept using a different management system.
Value gained	This represents the difference in the value of the non-pregnant cow at market if she was managed separately for a predetermined number of days versus the value of the non-pregnant cow at the time of calving if she was managed the same as the rest of the pregnant herd. This value is affected by the market price at the time of calving, the management system, the number of days on feed, the ADG, and the estimated market price at the time of culling (if different than the time of calving).
Fed cost	This is calculated by multiplying the cost of production for separated non-pregnant cows and the number of days they are on feed. It represents the financial cost associated with separating and feeding non-pregnant cows for a certain number of days before

	marketing.

Altogether, the addition of the overwintering cost (gain) and value gained minus the fed cost is multiplied by the herd open rate because the gain and cost are both only realized for non-pregnant cows.

Vet cost	The veterinary cost of pregnancy checking one cow is subtracted from the equation in as this service is independent of pregnancy status and is considered a financial cost in this alternative.

As above, the total herd savings is then calculated by taking the gain (or loss) per head and multiplying it by the size of the herd entered by the producer in Section 1.

Part C – Economic Model Data

Section 1 – Management Factors

For the first four management systems (drylot, swathed barley grazing, bale grazing and standing corn grazing), the cost of production, winter feeding period, average daily gain (ADG) and herd open rate are pre-determined variables found through secondary research of each management system. For the producer custom data, the values entered in Part A Section 2 are automatically put into the table for cost of production, winter feeding period, ADG and herd open rate.

The total gain over the winter was calculated by multiplying each respective ADG and winter feeding period.

The vet cost refers to the veterinary cost per head for pregnancy checking.

Section 2 – Market Factors

Historic average price	Average price in CAN $/lbs was calculated on a monthly basis using weekly D1,2 cow prices from 2005 – 2014.

Projected prices	Three columns were used to determine the projected monthly market price based on the known (current) market price of either September, October or November (as indicated by the producer in Part A Section 1 for "Current cattle market price"). Each projected price was determined using a monthly percent comparison factor that was calculated using the historic average price per month. See Section 4 for the percent change in cattle price.
Average live weight	Average fall weight (September – October) was calculated using the average cow carcass weight for western Canada of 688 lbs. from the 2014 CanFax Annual Report divided by a live-weight conversion factor of 53% (CanFax, 2014). Average spring weight (February – May) was calculated based on the average fall weight plus average daily gain (which varies with the type of management system) multiplied by the winter feeding period.
Value of cow	Is calculated based on monthly price per lbs. multiplied by either the average expected weight in the fall or spring.

Section 3 – Veterinary Cost and Open Rate

Average vet cost of preg check/cow ($)	The cost of pregnancy checking per animal was predetermined for management systems A-D (see Part 3 Section 1) and was entered by the producer for management system E (custom).
Average herd open rate	The average herd open rate was predetermined for management systems A-D (see Part 3 Section 1) and was entered by the producer for management system E (custom).

Section 4 – Percent changes in cattle price

Percent changes are used to estimate future monthly cattle market prices for D1,2 cattle. As in Part 3 Section 2, the monthly average cattle prices for D1,2 cattle were calculated based on averages of data from 2005-2014. The percent changes (positive or negative) were calculated per month based on either September, October or November to reflect the month that were chosen by the producer for pregnancy checking.

Section 5 – Cull cow separate group data

Weight of cull cow after feed	This weight corresponds to the weight of the cull cow after the feeding period (indicated by the number of days on feed in Part A Section 3). The average daily gain and number of days on feed were multiplied together and added to the average live weight from Part 3 Section 2.
Day cull cow was separated	This number indicates the approximate day of the year that the cull cow was separated from the herd. In other words, it represents the time of pregnancy checking in the fall.
Day cull cow was marketed	Calculated using the day the cull cow was separated plus the number of days on feed. The sum corresponds to the month that the cull cow would be marketed after being fed separately.

Appendix 3 – Interim Report for Literature Review of Cost of Production

Summary

The following report details information on the cost of over-wintering cattle in western Canada that will be applied to the project's cost-benefit model. Extensive winter grazing generally has a lower cost compared to drylot feeding, though the cost per day of similar management systems varied in two studies performed at the Termuende Research Ranch near Lanigan, SK. Establishing the type of management system used by the producer should be the first step in calculating the total over-wintering cost in the economic model. Differences in average daily gain between management systems should also be considered in the model, as it will impact potential return of the cow should she be culled in the spring. Total length of the winter feeding period varied widely among producers in Saskatchewan in 2011-12, and this factor should also be considered in the model.

Management Considerations

The model will need to address the overwintering costs of different management systems used by cow-calf producers. Several studies have compared the overall cost of different management systems in western Canada and have found a reduced cost associated with winter-feeding on pasture. An unpublished study from the University of Saskatchewan and Western Beef Development Centre (Jose, Lardner, Larson, Penner, & McKinnon, 2014) detailed the results of a three-year study at the Termuende Research Ranch near Lanigan, SK and found the following total over-wintering costs associated with three different management systems:

All costs in ($/cow/day)

Item	Standing whole plant corn	Swathed barley	Barley hay in drylot pens
Feed cost	1.28 (71.9%)	1.17 (70.9%)	1.37 (59.8%)
Bedding	0.05	0.05	0.08
Machinery	0.19	0.18	0.41
Labour	0.17	0.16	0.16
Yardage	0.05	0.05	0.14
Depreciation	0.04	0.04	0.13
Total Cost	1.78	1.65	2.29

Another study at the same research facility calculated the costs associated with over-wintering based on four different management systems (Kelln B. M., Lardner, McKinnon, Campbell, Larson, & Damiran, 2011):

All costs in ($/cow/day)

Item	Bale Grazing	Swathed barley	Straw-chaff barley grazing	Barley hay in drylot pens
Feed cost	0.83 (84.7%)	0.31 (40.8%)	0.16	0.86 (80.4%)

Supplement			0.72	
Labour	0.07	0.20	0.10	0.04
Equipment	0.08	0.25	0.29	0.14
Manure cleaning				0.03
Total cost	0.98	0.76	1.27	1.07

Similarly, a five-year study near Lacombe, AB determined the following costs of overwintering cattle (Baron, Doce, Basarab, & Dick, 2014):

All costs in ($/cow/day)

Item	Swathed triticale	Swathed barley	Swathed corn	Mixed hay drylot pens
Feed cost	0.27	0.47 (37.9%)	0.50	0.58 (29.3%)
Yardage (including feed processing, delivery, and manure removal)	0.37	0.60	0.40	1.12
Total cost (including bedding, salt and mineral)	0.78	1.24	1.05	1.98

For the purposes of the economic model, it is our recommendation that the average cost associated with each type of management system be used from previous studies. In the event of new published studies, the model can be updated to best reflect changes in feed and overhead costs.

Average Daily Gain

Jose et al. found that average daily gain (ADG), change in body weight, and change in rib fat were significantly different between management systems. Swathed barley grazing generally produced the lowest gains (0.12 kg/day) while standing corn and drylot feeding produced similar gains (0.53 kg/day and 0.41 kg/day, respectively). Similarly, differences were found in ADG between winter-feeding barley hay in drylots (1.98 lb) compared to swath grazing (0.89 lbs), bale grazing (0.88 lb) and straw/chaff grazing (0.47 lb) at the Termuende Research Ranch (Kelln B. , Lardner, Schoenau, & King, 2007). Thus, ADG differences between management systems should also be considered in the model, as gains over the winter will impact total value of the cow should she be sold in the spring.

Winter feeding period

In addition to the cost per day of over-wintering cattle, the model must also account for the total length of the winter feeding period. The average winter feeding period for 22 producers across Saskatchewan in 2011-12 was found to be 160 days, though it ranged widely from 130 to 219

days (Larson, 2013). We suggest that the producer be allowed to input their estimated length of the winter feeding period in the decision-making tool.

Reproductive efficiency

Kelln et al. (2011) found that calf birth date, calf weight, date of first calf born, date of last calf born, length of calving span, calving interval, and calving pattern were similar among cows in all four winter feeding systems over three production cycles. Thus it is a reasonable to assume that the economic model need not consider any effects on cow reproductive performance based on the management system of the producer.

Appendix 4 – Memo and survey sent to 173 veterinary clinics in Alberta and Saskatchewan.

Developing an Economic Model for Cow-Calf Producers
Veterinary Clinic Survey
April 2015

CanFax Research Services is funding a project to build an economic model that will be used to determine the *cost-benefit of pregnancy checking to Western Canadian cow-calf producers*. This survey was developed by Master of Business Administration (MBA) candidates, Alexandra Muzzin (DVM) and Elad Ben-Ezra (Final Year WCVM Student), in March 2015 for CanFax. Reproduction is the most significant component of cow production and it is essential to have a clear understanding of how management and usage of veterinary services can impact a producer's costs and financial efficiency.

The survey asks questions about your veterinary practice's involvement in pregnancy checking with cow-calf producers. The information collected will be used to develop an economic model for cow-calf producers. Individual responses will remain under the strictest of confidence and results from the survey will be published together to protect identity and information of survey participants.

The survey can be completed one of two ways:

- Complete the attached survey and mail it using the enclosed postage-prepaid return envelope by April 22, 2015, or
- Online using the following link: https://www.surveymonkey.com/s/8SGFFM7

The last day to complete and mail the survey is **Wednesday, April 22, 2015**.

The survey is 8 QUESTIONS in length and is estimated to take between 5-15 MINUTES to complete.

Thank you for your feedback. For further information about the survey or what the results will be used for, please contact:

- Elad Ben-Ezra – (306) 202-6064, eeb992@mail.usask.ca
- Alexandra Muzzin – (306) 716-6039, arm804@mail.usask.ca

Developing an Economic Model for Cow-Calf Producers
Veterinary Clinic Survey
April 2015

SURVEY QUESTIONS:

1. Please provide the full name and address of your veterinary clinic:

2. Do you provide veterinary services to cow-calf producers? (If yes, continue)
   a. Yes
   b. No (If no, stop survey and submit)

3. How many cow-calf producers do you provide service for each year?

4. Based on herd size, please indicate the number of cow-calf producers you provide services for:

< 50 head	
50 – 200 head	
> 200 head	

5. Out of the cow-calf herds above, how many herds do you pregnancy check each year?

< 50 head	
50 – 200 head	
> 200 head	

6. 80% of your cow-calf producer clients are within how many kilometers (km) of your clinic?

7. How many other mixed or food animal practices are located within 80km of your practice address?

8. How do you charge for pregnancy checking? (fill in all applicable boxes)

Per Hour? (Indicate charge/hour)	
Per Animal? (Indicate charge/animal)	
As Part of **Herd Health Program** (Indicate approximate charge allocated to pregnancy checking)	

[End of Survey.]

Appendix 5 – A consolidated breakdown of veterinary clinic survey results with calculated average cost of pregnancy checking per head.

Province	Clinic Name and Address	Does the clinic provide cow-calf services?	Average Price per Cow
SK	Warman Veterinary Services, Emerald Park	Yes	$4.00
AB	Weir Services, Lloydminster Alberta	Yes	$3.87
AB	Bear Creek West County Animal Clinics Ltd, Grand Prairie	Yes	$5.04
AB	Bow Valley Veterinary Clinic, Books	Yes	$4.48
AB	Veterinary Agri-health servives, Airdrie	Yes	$4.40
AB	Coaldale Veterinary Clinic, Coaldale	Yes	$3.33
SK	Animal Health Centre of Melville, Melville	Yes	$4.50
AB	Foothills Veterinary Clinic, Cardston. Country Vets, Pincher Creek	Yes	$3.55
AB	Lloydmninster Animal Hospital, Lloydminster	Yes	$4.52
AB	Barr-North Vet Services	Yes	$4.00
AB	Nagel & Co. Veterinary Services	Yes	$5.00
AB	Cremona Veterinary Clinic	Yes	$4.50
AB	Greenview Veterinary Clinic	Yes	$4.50
AB	Diamond Valley Veterinary	Yes	$4.00
AB	High River Veterinary Clinic	Yes	$3.50
AB	Taber Animal Clinic	Yes	$2.75

AB	Fort McMurray Animal Hospital	No	N/A
AB	Rimbey Veterinary Clinic 1991 Ltd	Yes	7.74
AB	Forestburg Veterinary Clinic	Yes	3.75
SK	Head for the Hills Vet Services	Yes	$4.82
AB	Lac Ste Anne Vet Services	No	N/A
AB	Alberta Veterinary Center	Yes	$4.75
AB	Animal Care Centre of Strathmore	Yes	$3.65
AB	Westlock Veterinary Centre	Yes	$4.05
AB	Rangeland Veterinary Clinic (1995)	Yes	$5.12
AB	Wetaskiwin Animal Clinic	No	N/A
AB	Cold Lake Veterinary Clinic	Yes	$4.80
AB	Iron Creek Vet Hospital	Yes	$2.82
AB	Central Veterinary Clinic	Yes	$4.00
AB	Edson Veterinary Clinic	Yes	$4.08
AB	Ranch Docs Veterinary Services	Yes	$4.50
AB	Vermilion Veterinary Clinic	Yes	$6.00
SK	Park Range Veterinary Services	Yes	$5.00
		AVERAGE	**$4.37**