Adopting genomics: financial benefits for Alberta beef producers

By Dawn Trautman and Tom Lynch-Staunton

It is a defining moment in the beef industry. Globally, input prices for beef production continue to increase at the same time demand for beef is projected to increase. Increased demand is attributed to population and income growth, largely in developing countries. However, trends in the domestic market tell a different story: beef consumption in Canada has decreased from an average of 25 to 21 kilograms consumed per person from 2003 to 2011. The decrease is associated with consumer perceptions of food safety, nutrition, environmental concerns, and a diverse selection of protein sources. Already, Canada exports about half of the beef produced; in 2012 beef exports were valued at over $1.2 billion . But, the primary destination for Canadian beef products is the United States, and due to regulatory changes, for instance mandatory Country of Origin Labelling or mCOOL, prices for Canadian beef have decreased. In order to adapt to changes, the industry must invest in innovative solutions to continue to breed the most efficient, productive, healthy, and profitable cattle possible by exploiting the best traits of each breed and ensure our producers lead the world in sustainable cattle production.

Genomics: Simply put, genomics is the extraction and analysis of DNA in order to identify important genetic markers, known as SNPs. It is a science that attempts to determine how DNA functions and what changes, or mutations, affect those functions by considering all genes and their components that work together in an organism.

For the beef industry, genomics could be a game changer. Traits that have the greatest potential for economic gain include carcass quality, tenderness, feed efficiency, fertility, immune response, and longevity. Using traditional methods, these traits are difficult to select for with accuracy and improvements are only observed over a number of years. Further, gains in selection of a trait often come at the expense of losing another important trait. Genomics can increase the accuracy of trait selection and can therefore increase the rate of genetic improvement in cattle. There is also potential to manage genetic defects while recovering valuable traits. Genomics can be used for parentage evaluation, a benefit that transfers to seedstock and commercial operations.

Livestock Gentec: Livestock Gentec is a research centre based at the University of Alberta. The centre was created in 2010 (and preceded by the Alberta Bovine Genomics Program) with the goal of transferring commercial benefits of genomics to the livestock industries. Livestock Gentec partners with other leading research institutions and networks, industry associations, government agencies, and private sector companies. Delta Genomics, a national, private, non-for-profit service arm of Livestock Gentec provides genotyping and sequencing services for the livestock industry and research community.

What we did: With funding from ALMA under the Strategic Initiatives program, Livestock Gentec contracted Abacus Bio Ltd of New Zealand, a group known for quantifying the value of genetic improvement in livestock, to examine whether it is cost effective to first record traits of value, such as birth weight, and use that information to make bull selection decisions. Once an estimate of the value of this “phenotypic” recording was established, they could then make an estimate as to whether applying genomics information would make economic sense.

The study does NOT tell us whether a specific genetic “profile” or DNA test like the Igenity or Zoetis 50K will give us a return on investment, rather it tells us whether trait recording has economic value for genetic improvement, and whether applying genomics to make EBV’s more accurate has economic value in genetic gain, as measured by $/cow mated/ year.

The study considers the impact of investment in genomic technologies in the beef sector on profitability at the cow and industry levels. Value of technology adoption is disaggregated by sector in the industry, including breeder, cow-calf producer, backgrounder, and feedlot/packer. The breeding objective is expressed in terms of dollars per cow mated per year, and is constructed using trait weightings, selection index modelling for genetic superiority, and finally as predictions of genetic gain using economic weights. The final value is the benefit of genomics adoption less additional production costs incurred, and is produced with the development of industry cost and genetic parameter models specific to the Alberta beef industry.

To assess the impact of trait recording and further technology adoption for genetic improvement within beef breeder herds, the analysis is based on the assumption that 100% of the industry records at least birth, weaning and yearling weights. Thus, this gives a benchmark as to what is possible with basic trait recording at an individual cow or industry wide level. Applying additional recording for maternal, feedlot, and packer traits gives an estimation of the value in genetic gain for comprehensive trait recording. Finally, the genomic technology adoption option is included as genomic breeding values (GBVs or Genomically Enhanced Breeding Values) with results obtained for assumed accuracies of 25 and 50% for traits of interest.

What we learned: According to the analysis, there is, in fact, a net benefit for trait recording and using that information to select bulls and heifers. Also, there are increased net benefits for recording more traits and from applying genomics to increase the accuracy of breeding values. in the beef industry. Lastly, gains are specific to the participants in the value chain; in a basic trait recording scenario, for example, it is estimated that cow-calf producers will get 40% of the value (due to improvements in birth weaning weight), the feedlot/packer sector will get 17% (due to weaning weight), while the beneficiaries of the remaining 43% are currently unspecified (since it is questionable as to who benefits from improvements in post wean gainsince both the cow/calf producer and the feedlot could benefit depending on retained ownership and when producers sell weaned animals).

If only current basic recording practices are used it is estimated that the value net benefit of genetic gain expressed as per cow mated per year is $3.90. Selecting for maternal and feedlot/packer traits alone using the current practices increases the values to $3.97 and $4.75, respectively. Combining selection of maternal and feedlot/packer traits increases the value to $4.81.

The addition of genomic technology, assuming a GBV accuracy of 25%, results in a value of $6.37 and $6.58 per cow mated per year for the base and comprehensive traits, respectively. If it is assumed that GBV accuracy is 50%, the benefits increase to $8.78 and $9.43 per cow mated per year for base and comprehensive trait recordings, respectively. This value is cumulative so as time passes and genetically superior heifers are retained, the value of your herd continues to increase to $18.86/cow mated/year and so on.

Accumulating the values over the Canadian beef herd, and over 15 years, with a discount rate of 7% results in annualized benefits of $127 million per year for the base recording scenario without genomic technology to $306 million per year for the scenario with comprehensive recording and GBV accuracy of 50%.

So, yes, trait recording has value, as does adding genomics information into the EBV’s, but it only has value if the breeder actually uses this information properly for choosing the best bulls (or heifers). Subsequently, it is also up to the commercial producer, the one buying these more “informative” bulls to use the information properly to choose the best bulls for his or her ranch.

The analysis also tells us that it is very important to establish your breeding goals and what has the most value to the producer. For example, if a producer is choosing bulls based on carcass traits, but selling his calves at weaning every year, he will not be realizing any value in genetic improvement for marbling or backfat, unless the buyer recognizes this and pays him a premium for these “superior carcass” calves. Furthermore, he will reduce the impact on his maternal traits because of overemphasizing selection on the wrong traits.

Because of this, it is very important for feedlots and packers to have the information so that they can source the best cattle appropriately. It also shows us that retained ownership, information sharing or alliances with feedlots and packers, and the use of maternal or terminal selection indexes are significant opportunities to put more dollars in the pockets of the breeder or commercial producer.

The importance of information flow throughout the supply chain is also highlighted in this study. To achieve the results presented above, it is assumed that information is shared between sectors in the industry. For example, if selection for carcass quality is not recognized, then the annual value per cow mated per year decreases by $2.56 in the base scenario, because cow-calf producers who are purchasing from bull breeders are not receiving a premium. In this case it is more profitable to focus efforts on attributes that are beneficial to the cow-calf producer, such as maternal traits. Further, to achieve increased adoption of genomics in the industry it is essential that benefits are translated in a manner that is clear to stakeholders. The use of economic indexes for example can result in greater genetic gain and increased value in the industry, due to transparency of information through the supply chain.

What it means: For the beef industry adoption of genomic technologies may be a wealth of opportunities. Used appropriately, the Alberta beef industry can position itself to be a competitive player in the global beef market.

The value gain of genomics is realized when combined with the basics of livestock breeding, including collecting phenotypes, defining a clear breeding objective, and with data collection, sharing, and management within the industry. Knowledge transfer and open access of information is essential to growth and success of this technology application. Adapting to change requires innovation, and genomics may be the economical answer for the beef industry.

For a copy of the full report, contact:
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In addition, Dr. Peter Fennessy from Abacus Bio will be presenting the results of the Cost-Benefit Analysis at the annual Livestock Gentec Conference, Oct.22-23, 2013, at the Coast Plaza Hotel in Edmonton, AB.

about ALMA

ALMA provides ideas, information and investment to help Alberta’s livestock and meat industry become more profitable, sustainable and internationally respected. Learn more at www.alma.alberta.ca. Contact: ALMA Communications, 780-638-1932 or email: nicole.paradis@almaltd.ca.