Virtual Beef

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New: Video on Stream, Ditch and Floodplain Management aimed at beef farmers

https://www.youtube.com/watch?v=KW47y2N-n84

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Graze Half and Leave Half:
Pasture Management for Sustained Productivity

Jack Kyle, Grazier Specialist, OMAFRA, Guelph

"Take half and leave half" is a grazing expression used to define a particular grazing management strategy. It is a broad declaration but can be utilized as an excellent starting point for an effective pasture management strategy.

Grazing management encompasses both animal and plant management. By leaving approximately half of the plant material after a grazing pass, ample green leaf remains for photosynthesis to occur and grow more leaves and roots. Leaves capture sunlight, while roots capture moisture and nutrients that are in the soil water. The ability of a plant to maintain high production levels through adequate photosynthesis is very important to growth efficiency.

In a recent study from Argentina, it was suggested that cattle bite into the top half of the canopy that exists in the pasture – whether it is tall or very short. Half of a tall plant will certainly be much greater than half of a short plant. This suggests that when plants are left tall, even when cattle graze half of the plant, plenty remains for regrowth. On the contrary, when half of a short plant is grazed, cattle are consuming much less forage and in addition, the plant will suffer the effects of over-grazing (low productivity).

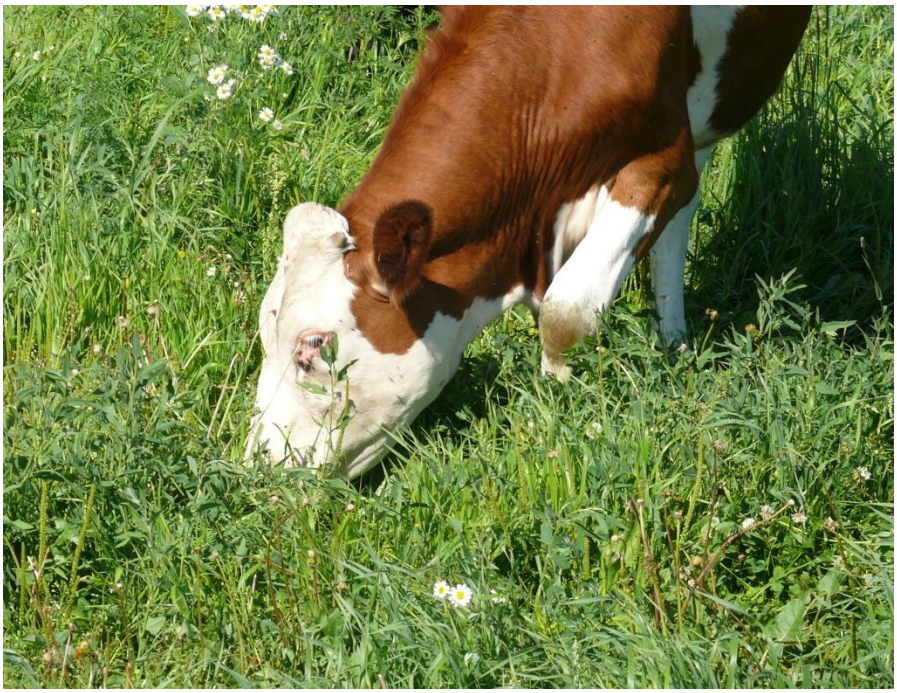

Figure 1. Cattle take 25,000 to 30,000 bites per day.

Animal intake is largely influenced by bite size and bite rate. Efficient feed intake can be optimized by controlling these factors. Animal performance relies on adequate intake. On average, cattle bite about 25,000-30,000 times per day, and in ideal situations, it has been shown that they will spend about 6.5-7 hours per day at a feed bunk in order to meet their intake requirements. Animals that need to search for food will graze considerably longer, but usually no more than 10 hours per day. This negatively affects the animal's ability to rest. They need to rest and ruminate to digest the feed that they have ingested throughout the day. Longer rest times correlate to more efficient animal productivity.

With a set number of animal bites per day, the pasture manager needs to ensure each bite is as big as possible. If the bites are small, the animal will require more bites per day to meet intake demands and will experience decreased rest times. Offering grass or forage that allows for a big bite size will optimize animal intake, resulting in more optimum performance.

Figure 2. Thick, vegetative pasture will provide optimum intake for cattle.

As mentioned, the “take half and leave half” concept is not always accurate or complete, but it provides an excellent reference for developing a successful management system. Once you are able to manage your pastures in this fashion, you will be able to successfully tweak the system to meet specific challenges that you are presented with.

For example, in situations where the pasture is very thick and vegetative, there is an opportunity to take more than half of the available forage. In this circumstance, when more than half of the forage is removed, there would still be a large amount of green leaves remaining to support continued plant growth and provide ground cover in order to help prevent the soil from drying out or becoming heated. When the ground is not adequately covered and bare soil is exposed, sunlight is able to reach it and heat the ground, accelerating evaporation of moisture from the soil. The cool season grass species that predominate in Ontario pastures have reduced growth rate when soil temperatures are too warm.

On the other hand, in pastures that are sparse and thin, taking half may compromise the ability of the remaining plant life to rebound, especially when challenging soil conditions or climate are a factor. In these conditions, you want to leave as much material as possible to regrow, providing ground cover and litter to protect the soil.

Essentially, the most important factor to consider is the amount of green leaf area left relative to total production. In difficult growing conditions, leaving more forage will put less stress on the desirable plant species and aid in their recovery from grazing. In this type of situation, the pasture manager should do everything possible to assist growth and improvement of the pasture, which means reducing the stocking rate.

In conclusion, “take half and leave half” is an excellent guideline and a great starting point. From this starting point however, the pasture manager must adjust for individual conditions of the pasture and growing environment. To develop and maintain a healthy productive pasture, the pasture manager must focus on the plant requirements first and adjust the animal numbers to the available forage.

The Grazing Index from Agriculture and Agri-Food Canada is a good reference.
http://publications.gc.ca/collections/collection_2014/aac-aafc/A59-22-2014-eng.pdf

Although this link is focused on western range management it provides some good information that is applicable to all pasture scenarios.

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Heart Rate: A Potential Tool for the Improvement of Feed Efficiency and More

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Times are Good in the Beef Industry…Right?

From the outside looking in, one might say "Must be good to be a beef farmer with all these high prices." Most cow-calf producers would agree. However, for farmers running feedlots and backgrounding operations, the outlook may not be quite as "rosy". These sectors operate on a margin, with the purchase cost of stockers and feeders representing a large proportion of operating costs. If these farmers were asked today, many would agree that this margin has not increased. So then how can beef farmers take advantage of high market prices without a parallel increase in their cost of production? A potential answer is by improving the feed efficiency of their cattle. Residual feed intake (RFI; measure of feed efficiency) is able to identify cattle that maintain gains and carcass composition while reducing feed intake. However, the determination of RFI requires the recording of individual intake, an expensive venture. Therefore, there is the need for alternative means of assessing feed efficiency on-farm. Our research group is working to develop heart function as a potential tool for meeting this need.

Making the Connection: From Heart Function to Feed Efficiency

The heart functions to deliver oxygen and nutrients to tissues of the body where they are used to supply the energy that is required for the animal to live, respond and perform. As this energy requirement changes so too does the heart's function. Energetic requirements are different between feed efficient (low-RFI) and feed inefficient (high-RFI) cattle, suggesting that heart function could also vary with RFI. A preliminary study from our group has shown that heart rate was different between low-RFI and high-RFI bulls during rest, transport and while at an abattoir[i].

Heart Control: the Role of the Nervous System

Before a method for using heart rate on-farm is developed, the control of the heart must be understood. The heart is controlled by two branches of the central nervous system (Figure 1), the:

1. parasympathetic nervous system (PNS)
2. sympathetic nervous system (SNS)

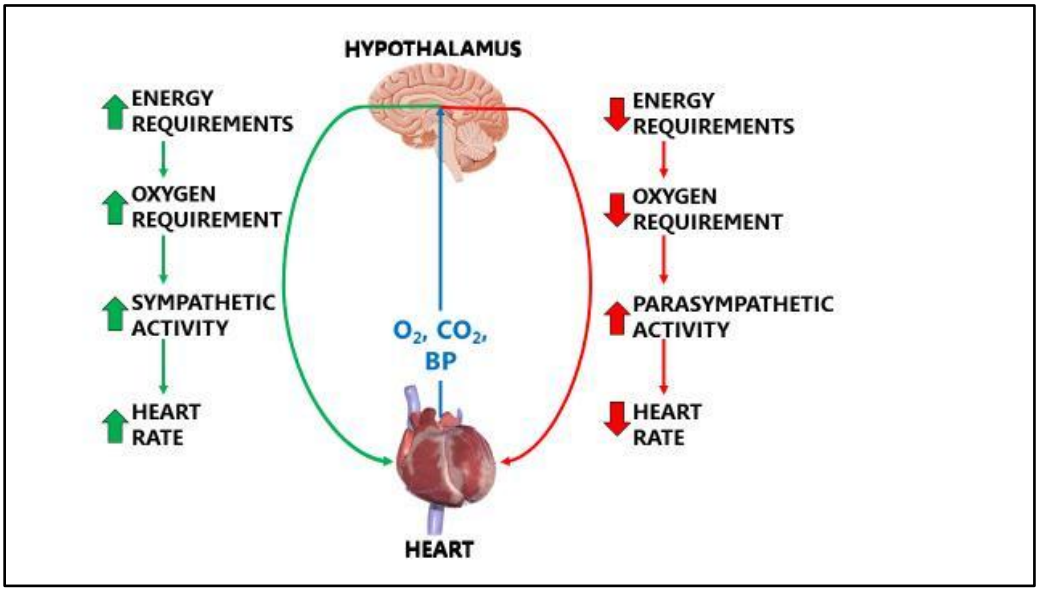

Figure 1. Heart control. Suggested route of action for a change in heart rate by changing the energy requirement of cattle. [O_2: oxygen level, CO_2: carbon dioxide level, BP:blood pressure]

Sensors located near the heart detect levels of oxygen, carbon dioxide and blood pressure. These sensors send signals to the brain (hypothalamus) which compares the signal to a set point that depends on a variety of factors including energy requirements. If oxygen levels are determined to be too low for the current energy requirement the PNS is inhibited and the SNS stimulated, causing release of catecholamines that act to increase heart rate[ii]. As RFI is also related to energetic requirements, heart rate changes could be different between low- and high-RFI cattle.

Study 1: On-Farm Heart Rate Assessment to Screen for low-RFI Cattle

This study is developing a heart rate assessment that could be used on-farm to screen for feed efficient cattle. Our objective is to cause short term changes in energy requirements so that a difference in heart rate response occurs between low- and high- RFI cattle.

Figure 2. Heart rate assessment technique, equipment and facilities used in Study 1 at the Maritime Beef Test Station. To cause this short term change in energy requirement, heifers of known feed efficiency were restrained in a squeeze chute and equipped with a heart rate recording harness (Figure 2). Heart rate was monitored prior to, during and after an umbrella was opened and closed in front of the heifer's snout (Figures 2 and 3).

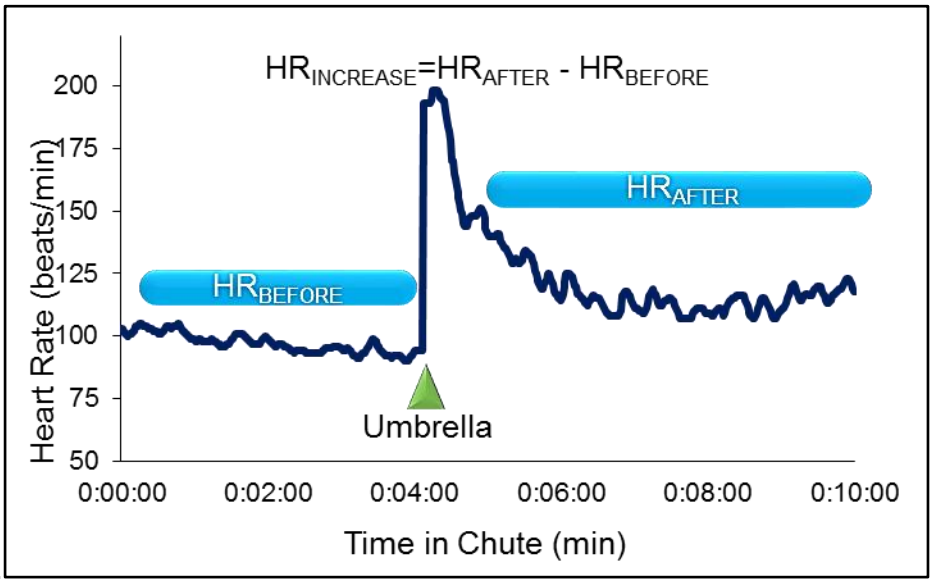

Figure 3. Heart rate monitoring protocol and traits assessed. HR_{BEFORE}; average heart rate before umbrella, HR_{AFTER}; average heart rate after umbrella, $HR_{INCREASE}$; heart rate increase: $HR_{AFTER} - HR_{BEFORE}$

Preliminary Results

Low-RFI heifers had a greater average heart rate after the umbrella (HR_{AFTER}) and a greater increase in heart rate due to the umbrella ($HR_{INCREASE}$). This suggests that low-RFI heifers may have a more responsive SNS causing an increase in

heart rate when energy requirements are increased. As high-RFI cattle have higher energy requirements their energy levels could have been high enough before the umbrella to accommodate a response without an increase in heart rate.

Study 2: The Underlying Biology: Understanding the Heart Rate-RFI Relationship

An ongoing research trial at the University of Guelph is attempting to further develop heart rate as an assessor for feed efficiency by diving into the biology of the cardiac system. At the Elora Beef Research Centre (EBRC), yearling bulls and steers of known feed efficiency were equipped with a heart rate monitoring harness (Figure 4) and heart rate was recorded during rest, handling, transport and at an abattoir. Stroke volume, the amount of blood the heart pumps per beat, was assessed on all cattle (Figure 5).

Figure 4. Yearling steer equipped with heart rate recording harness during Study 2 at the Elora Beef Research Centre.

At slaughter, heart tissue was collected and the heart was dissected (right ventricle, left ventricle, atria and pericardial fat) and weighed. Tissues of the heart will be assessed at both the histological (cellular) and molecular level (Figure 5) to determine if differences in heart cellular structure and receptor abundance occur between cattle of differing feed efficiency.

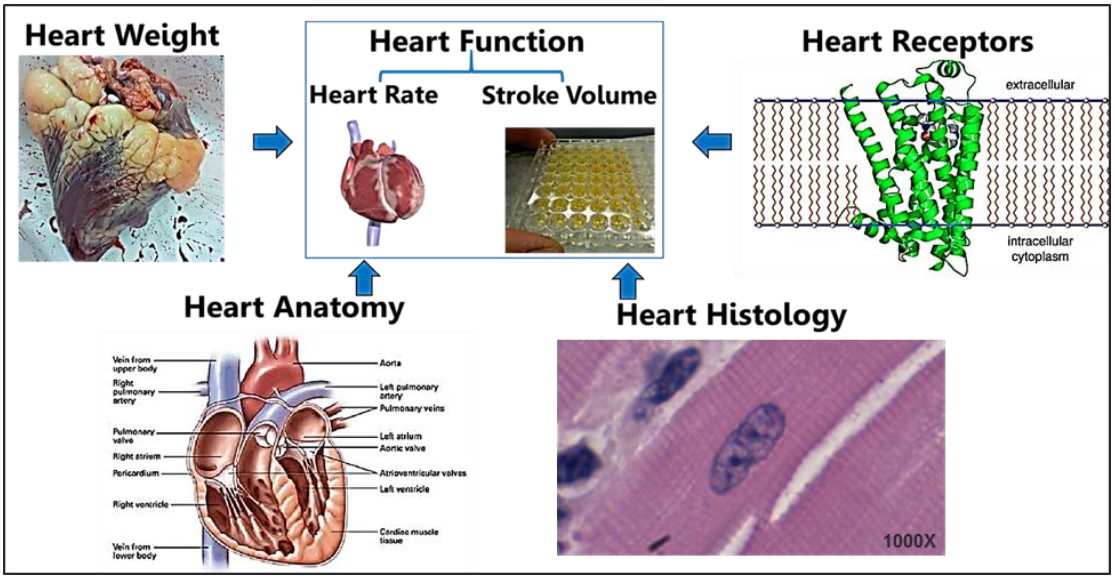

Figure 5. Biological assessments done, in progress or remaining on yearling steers and bulls in Study 2. All biological assessments have a tie to heart function.

Preliminary Results
Low-RFI cattle had a heavier right ventricle which is associated with increased sympathetic activity, supporting the SNS hypothesis proposed in Study 1.

Implications
With continuing development heart rate assessment could be used on-farm to screen for feed efficient cattle. The in-depth biological understanding of the heart rate-feed efficiency relationship will ensure both solid development of this potential technology and will assist in minimizing the potential undesirable outcomes that could arise from screening for feed efficient cattle with heart rate.

Bringing it to the Farm
Upon continued development the heart rate assessment could be used during routine handling practices on farm such as:

- weaning
- cattle processing
- any time cattle are passed through a squeeze chute

The earlier in life the assessment is done, the earlier feed efficient cattle can be screened, the more feed costs can be reduced and the more the farmer's margin can be increased.

There's More!
Recent research in cattle has observed heart rate to also be an indicator of:

- temperament, welfare and behaviour
- handling and pathological stress
- a potential indicator of time till calving and calving onset

Taken all together, these new studies may lead to heart rate being used on-farm as a versatile management tool.

References
[i]Montanholi Y.R., Lam S., Miller S.P. 2014. Heart rate assessment in beef bulls prior to slaughter is associated with feed efficiency. Book of Abstracts of the 65th Annual Meeting of the European Association for Animal Production, Copenhagen, Denmark 25-29 August 2014. Pg. 259.
[ii]Purves, D., Augustine, G., Fitzpatrick, D., Katz, L., LaMantia, A., McNamara, J., Williams, S. (Eds.), 2001. Neuroscience, 2nd ed. Sinauer Associates.

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Win-Wins on the Path to Sustainable Beef

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Sustainability has become an ideal for supply chains and now agriculture around the world. The global beef industry is on a short list of agricultural commodities under particular scrutiny. Keeping in mind that sustainability is the successful overlap of environmental balance, social acceptance and economic success, there are some fundamentals of Ontario production that are points of positive clarity. They are indeed good practices. Here I will focus on genetic opportunities as well as feed production and utilization as examples. Accompanying these are links to web resources that are publicly available as are many of the discussions in the increasingly e-based sustainability dialogue.

Social Acceptance via Genetics

Since the beginning of domestication, humans have applied selection pressure to cattle and other livestock to improve the utility of the animals. Selective breeding as a technique for continuous improvement is not under public scrutiny, and it offers opportunities to improve the position of the beef industry in terms of social licence and profitability. Two examples would be completing the adoption of polled genetics in commercial cattle and the use of high immune function genetics in the quest to reduce antibiotic use.

Polled = Zero Dehorning

Under the current Beef Code of Practice (which can be accessed at https://www.nfacc.ca/beef-cattle-code#section4) the sector has made it clear in section 4.4 that the farm recommendation is to "*use homozygous polled bulls where practical to eliminate the need for disbudding or dehorning*" and producers will be required to "*Use pain control, in consultation with your veterinarian to mitigate pain associated with dehorning calves after horn bud attachment".*

These will become the new normal, and is part of the progression to ending unnecessary pain in calves, essential in maintaining public confidence. I will go farther and say "get on with it!" as polled cattle no longer suffer performance lag. If you are not buying polled bulls you are missing the point; and if you are breeding and selling horned bulls, you are missing the point even more!

Figure 1. Full implementation of polled genetics is a good example of a technology that can could end hot-iron dehorning, improving animal welfare and ensure social licence.

Better Immune System = Less Antimicrobial Use

The use of antibiotics in farm animal production which are medically important for humans has come under serious scrutiny. Society in general, and in particular physicians have called for increased restrictions on their use in livestock. Although there is much debate about the relative contribution of veterinary antibiotic use to the development of antimicrobial resistance in human pathogens, two things are clear:

1. preserving antimicrobials for effectiveness in treating humans is of paramount importance
2. improving the immune system of livestock can reduce the need for antibiotics in the sector.

Improving the overall immune response in livestock through genetics would be a true win-win-win scenario. It would improve the welfare of the animal and thus societal acceptance and mprove the producer's bottom line by reducing veterinary expenses and boosting animal performance. There are new existing and emerging genetic technologies with the promise of achieving this. For example, Semex has recently launched a trait called **Immunity+ ™** in their beef catalogue which can be seen here: http://www.semex.com/beef/i?lang=en&beef=list&breed=AN&brand=IM, in addition to their dairy catalogue.

Improved Environment via a Sustainable Feed Supply

Major issues that have brought the global beef sector much scrutiny are the climate change and landscape impacts associated with cattle production. Most of these effects result from growing feeds and the digestive process of cattle. In particular, the degradation of soils to produce grain crops and the methane emissions resulting from feeding forage diets are problems. Using the feed supply as effectively as possible reduces the potential negative impacts on a per unit basis of beef produced. Both the Global Roundtable for Sustainable Beef (GRSB) and Sustainable Agriculture Initiative (SAI) speak to some of these issues. These can be accessed at www.grsbeef.org and www.saiplatform.org respectively. There are some elegant materials available through SAI, with one in particular being on methane reduction in livestock production available at http://www.saiplatform.org/uploads/Modules/Library/lrg-sai-livestock-mitigation_web2.pdf. This document summarizes strategies such as improved forage digestibility, improved feed ingredients, and precision feeding to reduce diet impacts. It also speaks to the use of genetics to improve feed utilization, and identifying animals that produce less methane due to inherent genetic potential. Typically, any strategy that ensures more feed energy is passed in a useable form to the animal means less methane. Technologies that reduce methane also tend to boost performance and feed efficiency as they are linked.

Figure 2. Careful feed analysis, ration formulation, mixing and delivery to phase-fed and split-sex fed cattle is the basis of precision feeding to reduce methane and boosting feed efficiency.

The point is that producers have the ability, via feedstuff management, to improve the environmental sustainability of their beef operations. And this will also reduce feed costs while assuring consumers that the sector is conscious of its environmental footprint and responding by using technology shown to reduce this impact per unit beef produced.

Sustainable Beef - Environment, Society and Economics

Although the paradigms around sustainable agriculture are often complex, properly applying the convergences of environmental, economic and societal needs via specific technologies can actually provide win-win situations. This is not to say that there won't be challenges as the global beef supply is required to achieve and verify sustainability. But as demonstrated with the examples of selective breeding for polled genetics and immune function, and better managed crops and feedstuffs, there are opportunities to ensure social licence for the beef sector via improved welfare, performance and potential for profit!

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Antimicrobial Resistance 101

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What is the Problem?

Anytime anyone uses an antimicrobial, be it in a human or an animal, it kills off the bacteria that are susceptible to that drug and leaves the resistant ones behind. It's the same concept as "natural selection" and "survival of the fittest". When the susceptible bacteria are wiped out, the resistant ones have room to grow and multiply, and before you know it you have the same number of bacteria again, but the antimicrobial that was used before doesn't work anymore. People are causing the antimicrobial-resistant bacteria to be "selected" for survival at a very rapid rate through frequent use of antimicrobials.

Some bacteria are also able to share the pieces of their DNA (genes) that make them resistant. "Superbugs" often have large sets of these genes that they've accumulated over time, making them resistant to most or all available antibiotics, leaving little or no way to treat the infected person or animal.

The main concern with antimicrobial-resistant bacteria is their spread to and infection of people in the community. While anyone can be infected, those most vulnerable include patients in hospitals and long-term care facilities, and individuals whose immune systems may not work as well due to age or illness. Animals can also get sick from infection with resistant bacteria. This is not only a concern from an animal welfare and production standpoint, but they also frequently carry these bacteria without showing clinical signs, making them a potential source for spread of these microbes to people. Even people who never touch a farm animal can come in contact with bacteria from livestock through the environment, water sources, animal-based food products, and even non-animal-based food products (e.g. fruits and vegetables that have been fertilized with animal manure, or cross-contaminated after harvest).

What Action is Being Taken?

Countries all over the world are taking action to try to reduce antimicrobial use (AMU) – in both humans and animals – in order slow the emergence of antimicrobial resistance (AMR). On the agriculture side, many European countries in particular are already making great strides in reducing AMU, and they are now looking to the US and Canada to join in a global struggle against AMR. Following a similar announcement by the US Food and Drug Administration, Health Canada intends to eliminate the use of medically important antimicrobials as growth promotants in livestock and poultry, by having drug companies remove the label claims on such products by the end of 2016. Table 1 shows Health Canada's categorization of antimicrobials used in livestock production. Medically important antimicrobials used in feed or water will also no longer be available to producers over-the-counter without some kind of oversight or authorization from a veterinarian (yet to be determined). Importation of these drugs for a producer's own use will also no longer be allowed, and importation of active pharmaceutical ingredients (i.e. drugs that need to be mixed or compounded before being administered) will also be more tightly controlled. For the most part, these changes will not affect antimicrobials of low importance to human medicine, such as the ionophores (e.g. monensin). While all these changes continue to take shape, it is critical for beef producers to stay in close contact with industry organizations like Beef Farmers of Ontario and the Canadian Cattleman's Association to ensure that your interests and concerns are properly represented, particularly at public consultations throughout the process.

Table 1. Categorization of antimicrobials by importance to human medicine (according to Health Canada)

Category of importance to human medicine	Antimicrobial class	Examples	Alternatives
I – Very High	Cephalosporins (3rd & 4th generation) Fluoroquinolones Penicillin-β-lactamase inhibitor combos Polymixins	Ceftiofur Enrofloxacin Amoxicillin & Clavulanic acid Polymyxin B (Colistin)	Few / none
II – High	Aminoglycosides Cephalosporins (1st & 2nd generation) Macrolides Penicillins	Gentamicin, Streptomycin Cephalexin Erythromycin, Tylosin Penicillin G, Ampicillin	Usually
III – Medium	Bacitracins Phenicols Sulphonamides Tetracyclines Pleuromutilins	Bacitracin Florfenicol variety of sulfa- drugs Chlortetracycline Tiamulin	For some
IV – Low	Ionophores Flavolphospholipols	monensin, lasalocid bambermycin	N/A

What can I do to help?

Every person has a role to play in helping to stem the rising tide of antimicrobial resistance. Work with your veterinarian to ensure you have effective biosecurity practices in place to minimise the risk of disease introduction and spread. Keeping your cattle healthy by providing good nutrition, a clean low-stress environment, clean air (i.e. good ventilation) and avoiding issues like over-crowding can significantly reduce the need to use antimicrobials in the first place. When antimicrobials are needed, use them wisely to ensure each use is as effective and efficient as possible. (See tips below.)

Maintaining public trust – By the numbers

Agriculture needs to take ownership of its role in the fight against rising antimicrobial resistance, and communicate positive actions and progress (in terms of reducing AMU) to the public in order to maintain their trust and the social license to access and use these drugs when they're really needed.

In order to demonstrate such progress, we need numbers: how much, how often, what kinds and in what animals are antimicrobials being used, and how is that use changing over time. In some sectors, and on many highly modernized production facilities, this information is already being collected for other reasons, such as quality assurance programs. With a little bit of effort, these data could potentially be collected and compiled by each sector to provide those much-needed numbers about baseline antimicrobial use. Over time, they can be used to show trends and progress, as efforts to improve management, vaccination, biosecurity, and genetics gradually decrease the need for and frequency with which antimicrobials are used in food animals. Talk to your industry association representatives and your fellow beef producers about how this might most efficiently be accomplished for beef producers in every sector.

Tips for Reducing Illness and the Need for Antimicrobial Use:

- Reduce stress: strategies such as preconditioning and low-stress weaning take some extra time and effort, but can certainly be worthwhile especially in terms of reducing the need for antimicrobials. Low-stress handling and avoiding things like overcrowding are also important for animal welfare.
- Biosecurity: it's often not possible to avoid mixing cattle from different sources, but reducing the amount of mixing whenever and as much as possible can still be very beneficial. Also be sure to separate sick animals promptly to reduce the spread of infection.
- Vaccinate: vaccination helps prevent disease before it starts, and "herd immunity" can even help protect unvaccinated animals by reducing the amount of bacteria and viruses circulating in a group.

- Talk to your veterinarian: you and your veterinarian are the best team to identify the specific strengths and weaknesses on your operation that are the most critical to reducing antimicrobial use and improving animal health while maintaining profitability.

Tips for using antimicrobials wisely when they're needed:

- Know what you're treating: antimicrobials only work on bacteria, not viruses, and some conditions (for example lameness) can be caused by things other than infection.
- Pick the right product: don't crack a walnut with a sledgehammer. Avoid pulling out a powerful broad-spectrum antimicrobial when there's a drug that will more specifically target the infection you're trying to treat. This is often better for the animal and it's better for reducing the risk of resistance overall.
- Follow instructions: make sure you use the appropriate dose and route, and treat the animal for the right number of days. This will maximize the effectiveness of the antimicrobial, and avoid residues when the standard withdrawal time is observed.
- Treat sick cattle promptly: this typically results in a better response and decreases the need for additional treatments.
- Keep good records: the only way to know for sure if your strategies and treatment regimens are working consistently is to keep track of what animals get sick, how they are treated, and how they respond. This information should be reviewed regularly with your veterinarian to help ensure antimicrobials are being used in the most effective way possible, and to identify any other areas where preventative strategies could be used or improved.
- Know when to euthanize: don't use antimicrobials to treat an animal that is unlikely to survive as a "last ditch effort". Save the antimicrobials for the cases in which they are likely to be effective.

Additional resources and information:

http://cattle.ca/

http://www.beefresearch.ca/research-topic.cfm/antimicrobial-resistance-11

http://www.newswire.ca/fr/story/1511073/government-of-canada-hosts-roundtable-discussion-to-advance-canada-s-work-on-antimicrobial-resistance

http://healthycanadians.gc.ca/publications/drugs-products-medicaments-produits/antibiotic-resistance-antibiotique/action-plan-daction-eng.php

http://www.inspection.gc.ca/animals/terrestrial-animals/biosecurity/standards-and-principles/beef-cattle/eng/1378825897354/1378825940112

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