

Perspectives on Biosecurity for Canadian Dairy Farms and AI Studs

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Take Home Messages

- A broad approach to biosecurity addresses the risks of incursions of foreign animal disease, between and within herd spread of endemic disease and animal to human transmission of zoonotic disease.
- Farm level targeted programs addressing economically important endemic diseases need to be established and enhanced. Perhaps the most important single element is a serious 'buyer beware' approach to animal purchases.
- Bulls destined to serve as semen donors must come from healthy herds that maintain high standards for endemic disease surveillance and control.
- Attention to the direct and indirect risk to human health will continue to grow as a focal point for agricultural sustainability.

Animal Health

Dairy producers and the veterinarians who serve them are committed to maintaining the health and welfare of the Canadian dairy herd. In return for the privilege of marketing milk, they are bound by the provincial acts and regulations which in many instances compel them to ship milk to the market from healthy cows. Beyond promptly treating diseased individuals, health maintenance is about minimizing the risk for disease transmission to and between individuals, and among groups.

Diseases of dairy cattle are many and can be subdivided into various groups or categories based on their etiology (agents which cause disease), pathogenesis (the mechanisms by which diseases develop, such as infectious or metabolic), epidemiology (the combination of risk factors which together cause disease events, such as environmental or contagious) or their outcomes (morbidity, mortality or production limiting). Furthermore diseases can manifest clinically or sub-clinically, can cross species barriers and will sometimes affect humans (zoonoses). All in all, there are many diseases of dairy cattle and many have serious impacts including direct losses attributable to treatment, production loss and death, and indirect losses such as market access restriction and failure to realize genetic gain. It is beyond the scope of this presentation to discuss these in detail, but the following table will serve to illustrate some of the diseases of current interest to the Canadian dairy producer.

Table 1: Major Diseases Impacting Canadian Dairy Herds

Category	Importance	Infectious Example	Non-Infectious Example
Udder Health	Milk Quality & Yield	<i>Staph aureus</i> mastitis	<i>E. coli</i> mastitis
Lameness	Welfare & Productivity	Digital Dermatitis	Claw Horn Disease
Calf Disease	Herd Replacement	Diarrhea & Pneumonia	Underfeeding & Poor Colostrum
Foreign or Exotic	Trade & Survival	Foot & Mouth Disease	
Production Limiting	Milk, Meat & Calves	Johne's Disease, Enzootic Bovine Leukosis, IBR, BVD	Sub-clinical Ketosis and Sub-acute Ruminant Acidosis
Zoonosis	Consumers & Farm Family	Cryptosporidiosis	

Biosecurity

Biosecurity is a term used broadly in animal agriculture, but one that has many definitions. While many think of biosecurity in terms of preventing introduction of foreign animal disease or highly infectious endemic disease, there are much broader definitions that fit our agricultural systems better. Among the most encompassing definitions for biosecurity is one published by the Australian Biosecurity service; "Biosecurity is the protection of people, animals and ecological systems against disease and other biological threats" (<http://www1.abcrc.org.au/pages/About.aspx>).

Based on such a broad and all encompassing definition, biosecurity for animal production systems includes at least four distinct, but not necessarily mutually exclusive, components. It includes minimizing the risk of A) incursion of a foreign animal disease into a country (Foot & Mouth Disease); B) spread of an endemic disease among herds and regions within that country (Digital Dermatitis); C) spread of an endemic disease among individuals and management groups within a particular herd (Johne's Disease); and D) transmission of zoonotic agents from animals to the people who work with the animals and/or consume their products (*E. coli* O157).

Perspectives on Biosecurity – Degree of Engagement

Development and implementation of biosecurity standard practices has varied across agricultural commodity groups. The poultry industries continue to lead the pack and have chosen, for very good reasons, to promote an intensive and all-perils approach.

Given the structure of their industries, their management systems and the large number of exotic and endemic diseases with serious consequences for their flocks, this is clearly the best approach for that industry sector. The pork industry has chosen a more moderate and variable approach, ranging from the maintenance of highly secure high health herds, to much less secure herds with prevention programs targeted at specific pathogens and threats. The ruminant industries (cattle, sheep and goats) have taken a more basic approach and have on occasion come under fire for their apparent neglect of biosecurity. Critics point to the significant number of epidemics which have swept through Canadian dairy herds in the last 20 years, including acute BVD, Digital Dermatitis, Neosporosis and Johne's Disease. While there is no compelling argument for implementing the intensive and all-perils approach in the dairy industry, there is a need to develop best management practices that will decrease the risk of disease introduction and transmission.

Vigilance Against Foreign Animal Diseases

Most animal health professionals agree that while the likelihood of a foreign animal disease incursion is small, the costs associated with such an event can be incredibly high. Experience gained through observation of the Foot and Mouth Disease outbreak in the United Kingdom and the Avian Influenza breaks in British Columbia has generated increased preparedness activity across most animal and poultry industry groups. Over the last five to ten years we have seen the formation of strategic organizations such as the Ontario Livestock and Poultry Council, for the explicit purpose of raising awareness and promoting preparation for the inevitable next FAD outbreak. In addition to advocating for increased surveillance and laboratory capacity, inter-industry communication and disaster response plan preparation, they have been influential in organizing a series of industry-government FAD simulations to test these activities. Attention has been focused on all aspects of emergency management, including prevention, preparedness, mitigation, response and recovery. Federal and provincial dollars have been made available to fund research and implementation of emergency prevention and response strategies. Government, industry partnerships have pursued the development of insurance products to deal with post-emergency recovery and restoration of production and trade. While we may never be fully prepared for the next FAD incursion, our level of preparedness has progressed significantly in recent years and should continue to do so in the foreseeable future.

Managing the Risk of Endemic Disease on Dairy Farms

Many producers and veterinarians will argue that the daily losses due to morbidity and mortality associated with endemic diseases such as contagious and environmental mastitis, infectious lameness and enteric diseases are of far greater concern to the dairy industry than the risk of a FAD incursion. In recent years we have witnessed the

emergence and spread of several economically important 'new' diseases across the country. These include Digital Dermatitis, acute Bovine Viral Diarrhea (BVD), Neosporosis and Johne's Disease, to name a few. Given the frequency with which animals move from herd to herd and province to province, the spread of these diseases from infected to susceptible herds has been rapid and complete. Herd expansion with indiscriminate accumulation of cattle from multiple sources has been a major contributor to disease spread. While the risks associated with cattle purchase have been broadly discussed, there is little evidence the dairy producers have taken a serious 'buyer beware' approach. Surveys of dairy producers in the United States and Canada indicate that a minority of cattle buyers ask about the health status of the animals they are purchasing or the herds from which they are being sourced (1, 2 & 3).

Few dairy herds have followed the lead of poultry and swine producers in adopting intensive farm level biosecurity practices aimed at keeping any and all infectious diseases out of their production units. Whether the current activity aimed at the development of national farm-level biosecurity standards for the dairy sector will change that, is not clear. There are opportunities to implement targeted biosecurity programs on dairy farms, aimed either at minimizing the risk of introducing specific diseases not currently present on a farm to the herd, or at decreasing the transmission of existing infectious diseases from infected to naive animals or groups on the farm. Drivers for activity in these areas include the impending reduction in the somatic cell count (SCC) penalty level for marketed milk and the roll-out of provincial Johne's Disease control programs across much of the country.

Targeted biosecurity programs are developed by dairy producers and their veterinarians through a series of steps. In most cases they include identifying diseases of concern, establishing the prevalence of the disease on that farm, limiting the movement of animals onto and within the farm, implementing disease control measures that are practical given the unique farm management, monitoring compliance with the program and annually reviewing and revising the program. One example of such a program is the Ontario Johne's Education and Management Assistance Program, established by an industry working group and funded by the dairy and beef industry partners. The program is targeted at minimizing the risk of introduction of Johne's Disease by promoting an 'ask before you buy' approach, and decreasing the risk for disease transmission from infected adults to newborn calves through appropriate calving management and calf husbandry. An annual on-farm risk assessment carried out the herd veterinarian serves to identify areas of highest risk which should be targeted for remediation. Testing of the entire herd to estimate the prevalence of disease is optional, as is the removal of adults identified as being at high risk of shedding the causal agent, *Mycobacterium avium* subspecies *paratuberculosis* (MAP). Details about the program are available on the program website: www.johnes.ca

Public Health, Food Safety and Occupational Health and Safety

The broader definitions of biosecurity include the transmission of infectious agents from animals and animal products to people. These people include farm families and employees, farm visitors and consumers of milk and meat products. Diseases of interest in this context fall into three broad categories. The first group includes pathogens which cause disease in both animals and humans, so are easily identified and are of enough importance to warrant control activities. These include Cryptosporidiosis, Rabies, Ringworm, Brucellosis and Leptospirosis. The second group includes pathogens that pose significant risk to people, but seldom if ever cause serious disease in animals, which makes them much more difficult to identify and there is less motivation to control them. These include Salmonellosis, Listeriosis, MRSA, *Clostridium difficile*, *Campylobacter* spp. and *E. coli* O157H7. The third and final group includes pathogens that cause disease in cattle, but seldom if ever are zoonotic (cause disease in people). These include MAP and Bovine Spongiform Encephalopathy (BSE).

Biosecurity approaches for these risks include maintaining healthy cows in a healthy environment, practicing proper hygiene in the harvesting and storing of milk and meat, pasteurizing milk consumed on the farm, ensuring that all drinking water is potable, and wash your hands.

High Health Dairy Herds as Sources of Semen Donor Bulls

Bull calves selected as potential semen donors must originate from dairy herds with a high health status. While there are no official criteria for designating dairy herds as 'high health', the applicable federal regulations specify that these herds must be under regular veterinary care and must be inspected and found free from clinical infectious disease and a history of no infectious disease during the 60 days preceding the movement of a candidate bull calf from the farm to the AI stud. Diseases of interest include Brucellosis, Leptospirosis, Bluetongue, Johne's Disease (Paratuberculosis), Enzootic Bovine Leukosis (EBL), Epizootic Hemorrhagic Disease of Deer, Bovine Viral Diarrhea (BVD) and Infectious Bovine Rhinotracheitis (IBR). Visual inspection of all animals and especially the candidate animal are carried out by federally accredited veterinarians. Candidate animals are tested for these diseases prior to leaving the source farm and twice during their stay in an isolation facility at the AI stud. Recognizing that all tests are not equal in sensitivity or specificity, there is a short list of approved tests for each disease (see Table 2), and a short list of accredited laboratories permitted to perform the testing. Details are available on the Canadian Food Inspection Agency website at the following URL (<http://www.inspection.gc.ca/animals/terrestrial-animals/diseases/accredited-veterinarian-s-manual/chapter-10/eng/1345478300520/1345478379509>).

Table 2: Diseases of Interest and Approved Tests for Semen Donors in Canada

Disease	Test
Brucellosis	Serum tube agglutination test (TAT) and serum complement fixation (CF)
Tuberculosis	Intra-dermal purified protein derivative (PPD) bovine tuberculin
Leptospirosis	Serum microscopic agglutination test (MAT)
Bluetongue	Serum competitive ELISA (c-ELISA)
Johne's Disease	Serum ELISA and agar gel immune-diffusion (AGID)
EBL	Serum ELISA
EHD Type 2	Serum AGID
BVD	Serum immunoperoxidase and serum neutralization (SN)
IBR	Serum ELISA

(Adapted from Chapter 10 of the CFIA Accredited Veterinarian's Manual - 2013)

Biosecurity practices at the AI Studs are the highest in all of the dairy industry. The barns and feed areas are fenced with restricted entry to prevent unauthorized visitors from entering the animal areas. All staff and service people entering the stud must enter with clean clothes and must have showered after their last animal, or animal facility contact. All service vehicles delivering feed and bedding are to required to make the AI stud the first stop of the day and must disinfect all tires with Virkon before entering the animal area.

References

1. Faust, MA, Kinsel, ML, Kirkpatrick, MA. Characterizing biosecurity, health and culling during dairy herd expansions. *Journal of Dairy Science*, 2001. 84:955-965.
2. Hoe, FGH, Ruegg, PL. Opinions and practices of Wisconsin dairy producers about biosecurity and animal well-being. *Journal of Dairy Science*, 2006. 89:2297-2308.
3. Sorge, U, Kelton, D, Lissemore, K, Godkin, A, Hendrick, S, Wells, S. Attitudes of Canadian dairy farmers toward a voluntary Johne's disease control program. *Journal of Dairy Science*, 2010. 93:1491-1499.