ACFA Symposium:

Reducing the Risk of Bovine Cysticercosis

May 28, 2014, Coaldale, Alberta

Feedlot owners and operators, academics, government officials, and potato producers and processors were all on hand at a recent symposium sponsored by the Alberta Cattle Feeders' Association. The symposium—a day-long event held on May 28, 2014 in Coaldale, Alberta—was designed to share information on *Bovine Cysticercosis* in feedlot cattle and discuss ways to reduce the risk of infection.

Dr. Richard Beekman, Veterinary Program Specialist with the CFIA.

Bovine Cysticercosis (C. Bovis or "Beef Measles") results when cattle ingest feed or other material contaminated with *Taenia Saginata (T. Saginata)* eggs. Once ingested, viable eggs mature into larvae, which then produce cysts in the muscle tissue of cattle. While *C. Bovis* does not represent a serious threat to human health, and any affected beef is prevented from entering the food supply through CFIA inspection at slaughter, the infection remains a reportable disease that once discovered, is most certain to result in substantial financial losses for a feedlot.

These losses come in the form of penalties imposed at the processing plant, reduced carcass value, condemned carcasses, mandatory quarantine, the time and expense of cleaning and disinfecting the premises, and the capital cost of rehabilitating or replacing feedlot infrastructure. In addition, the disease is almost certain to result in significant downtime. Under government regulations, a feedlot diagnosed with *C. Bovis* cannot be restocked until all infected cattle have been shipped and slaughtered under enhanced CFIA inspection, and the infection and its source eliminated.

C. Bovis infection is rare in Canada, and reported cases have been sporadic, isolated, and geographically dispersed. At the same time, this does not mean that feedlots should consider themselves to be at low risk. There are numerous reasons why producers should exercise caution and consider implementing preventive measures.

First, the potential financial fallout of a *C. Bovis* infection is considerable. Second, cattle that are infected do not present clinical signs. Diagnosis occurs only when cysts are found during carcass inspection. At that point, the disease has already taken hold. Third, while government compensation is available for feedlots affected by a *C. Bovis* incident, not all costs are eligible for compensation and secondary or multiple infections are not covered.

Symposium Presenters

Attendees at the Alberta Cattle Feeders' Association symposium on *Bovine Cysticercosis (C. Bovis)* heard from five speakers. Dr. Mark Nelson of Washington State University has spent considerable time researching the disease, particularly various outbreaks that have occurred in Washington state and other areas of the U.S. Pacific Northwest. As the keynote speaker, Dr. Nelson focused on the value of "wet" feed sources and ways to mitigate the risks of *C. Bovis* infection. Dr. Richard Beekman, a Veterinary Program Specialist with the Canadian Food Inspection Agency (CFIA), provided a view of the disease from the regulatory perspective. Pamela Hodgkinson addressed issues related to public health, while Ryan Kasko and Dr. Phil Klassen spoke about the practical issues and concerns that will confront a feedlot "on the ground" should a *C. Bovis* infection emerge.

Speakers at the ACFA symposium included (from left to right) Pamela Hodgkinson (Alberta Health Services), Dr. Richard Beekman (Canadian Food Inspection Agency), Dr. Mark Nelson (Washington State University), Ryan Kasko (Alberta Cattle Feeders' Association), and Dr. Phil Klassen (Coaldale Veterinary Clinic Ltd.).

PRESENTATION #1: Dr. Mark Nelson, Washington State University

Washington State University professor Dr. Mark Nelson opened the symposium by presenting a brief history of *C. Bovis* outbreaks in the U.S. Pacific Northwest, with a particular focus on Washington state. In 2006, the Food Safety and Inspection Service (FSIS) of the USDA reported 720 infected cattle in Washington (almost 75% of all cases that occurred in the US that year). In 2009, another outbreak produced 682 confirmed cases in Washington (representing 85% of all cases across the US in that year). In researching these cases, Dr. Nelson uncovered a link between *C. Bovis* infection and the use of various "wet" feed sources, particularly potatoes and the co-products of potato processing. Co-product is material generated during food processing that has no value for human consumption. Typical examples include culled vegetables, bits and pieces, slurry, peels, screened solids, and pulp.

The linkage disturbed Dr. Nelson because feeding vegetables and vegetable processing co-products can be advantageous. Not only is the supply of this feedstuff predictable and consistent, it is cost-effective. Cattle feeders can use a feed source that is less expensive than grain, and potato producers and processors can avoid the expense of disposal, such as tipping fees at a landfill. Dr. Nelson also reported that potatoes and potato co-product have good nutritional value, and including them in a feed ration does not impact on beef quality or taste.

Dr. Mark Nelson considers a presentation given at the ACFA symposium.

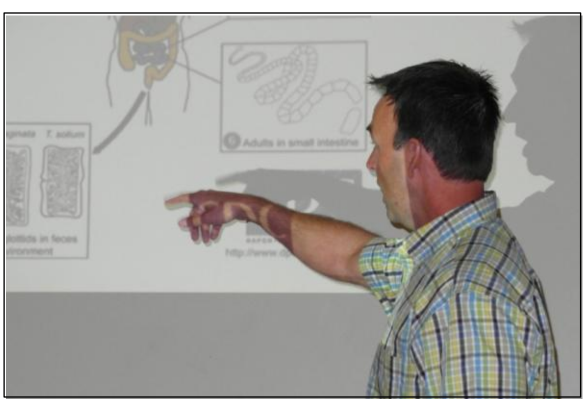
For these reasons, potato production and cattle feeding share a mutually beneficial intersection in southern Alberta. Not only is the region is home to plenty of cattle, it is home to plenty of potatoes and plenty of potato processing. Potato production in the province currently approaches 900,000 tonnes annually, of which 5% is for the table, 15% is for seed, and 80% is processed. The co-product from potato processing alone approaches 175,000 tonnes annually, which can be used to feed up to 100,000 head of cattle.

At the same time, the practice of feeding vegetables and vegetable processing co-product has a downside. Any feed ration that includes vegetables has to be monitored, properly managed, and carefully balanced with other ingredients. There are also large volumes of water contained in potatoes and potato co-product—it is a "wet" feed source. This is the point at which risk enters the feeding picture. The *T. Saginata* eggs that cause *C. Bovis* require a relatively moist environment in order to survive and remain viable. But once subjected to sufficient heat or a sufficiently dry environment, the eggs cannot survive and the risk is dramatically lowered, if not entirely eliminated.

PRESENTATION #2: Dr. Richard Beekman, Canadian Food Inspection Agency

Dr. Richard Beekman, a Veterinary Program Specialist with the Canadian Food Inspection Agency (CFIA), noted that while *C. Bovis* is a reportable disease in Canada, it has a very low prevalence. Out of the approximately 2.7 million cattle slaughtered annually in the country, inspectors find very few to no infections. Since 2000, there have only been eight instances of *C. Bovis* found in Canada, and all of them were restricted to Quebec (5), Ontario (1), and Alberta (2).

In Quebec, one of the infections was traced back to cabbage that was used in a feed ration. An Alberta feedlot was found to be infected in 2000, with the source being traced to the water supply downstream from a local town. Another instance emerged in Alberta in 2013. This time, the source was suspected to be contaminated potatoes or potato processing co-product. This instance was particularly severe, with hundreds of animals being affected.



Dr. Richard Beekman, Veterinary Program Specialist with the Canadian Food Inspection Agency (CFIA) explains how the agency monitors for *C. Bovis* in the inspection process.

The CFIA and public health officials will immediately launch an investigation whenever *C. Bovis* is suspected. Few stones are left unturned, with feed, water, sewage, and people all considered to be potential sources. Quarantine will be imposed to restrict movement and ensure that all potentially infected animals are kept separate and can be more rigorously inspected. If feed is suspected as a source, the investigation will be expanded beyond the feedlot to the entire feed supply chain. Cleaning and disinfecting must also take place, with the level of intensity dependant on the source. If the source is unclear, disinfection must address all potential sources. No restocking can occur until the feedlot is cleaned and disinfected and all animals have been slaughtered under enhanced CFIA inspection.

At the processing plant, any suspect sample is sent to a laboratory and the carcass is held pending results. If the result is negative, the carcass is released. If the result is positive but has fewer than four cysts, the carcass is trimmed and either heat treated at 60°C or cold treated at -10°C for 10 days. If four or more cysts are found, the carcass is condemned.

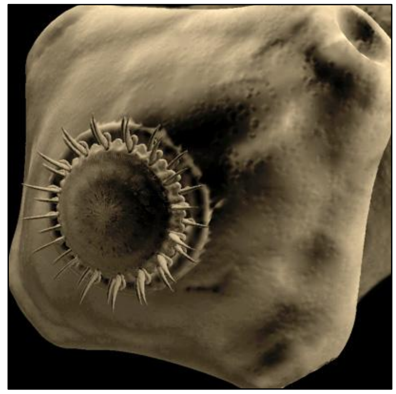
PRESENTATION #3: Dr. Phil Klassen, Coaldale Veterinary Clinic

Dr. Phil Klassen, a southern Alberta veterinarian, spoke to the wide range of activities that occurred "on the ground" following a recent discovery of *C. Bovis* in a southern Alberta feedlot. In this particular instance, the exposure was at relatively low levels but it was quite widespread, being found right across the operation. Once discovered, a response plan had to be constructed. The initial focus of the plan centered around two immediate goals—identifying all possible sources of contamination (e.g., feed, water, human contact) and preventing any further contamination and infection of healthy cattle.

Dr. Klassen played a key role in developing—at the CFIA's request—a protocol for the cleaning and disinfecting of the feedlot. The protocol he developed, and that was subsequently approved by the CFIA, centered around desiccation (creating conditions for extreme drying) and the "flaming" of all potential contact surfaces. Specific activities in the protocol included the testing of workers, sanitizing facilities, cleaning and drying pens, improving the water supply system, flaming the pens and feed bunks, and cleaning feed storage areas and equipment.

Dr. Klassen was clear that a *C. Bovis* incident can be very costly for a feedlot. Expenses include lost carcass value, reduced market access, having to ship fed cattle at an inopportune time, no ability to place new cattle, and the capital and labour costs of the clean-up. If these costs were not enough, there is also the human cost—stress. And while the human toll may be impossible to quantify, it is no less damaging.

The source of *C. Bovis* outbreaks are often difficult to determine. That being the case, producers should work to mitigate their risk by exercising caution with those feedstuffs that are at high risk for transmission of the parasite. This includes wet feedstuffs that are produced in close contact with people. Ensiling such feed and preventing humans from coming into contact with cattle or feed are two such cautions.



Taenia Saginata eggs are the source of C. Bovis infection, which produces cysts in the muscle of cattle.

PRESENTATION #4: Ryan Kasko, Alberta Cattle Feeders' Association

Ryan Kasko is a Director of the Alberta Cattle Feeders' Association (ACFA) and the owner of the Kasko Cattle Co. In his presentation, Mr. Kasko focused on the role played by ACFA in helping industry work through the *C. Bovis* incident. ACFA took the lead in initiating and facilitating a process of ongoing communication between industry, government, and the packers, and also played a key role in negotiating the conditions under which the packers could process the affected cattle under an enhanced CFIA inspection.

The symposium was also provided with a look at a range of new investments made at the Kasko Cattle Co. to lower their own risk of a *C. Bovis* infection. Investments include systems that can better secure a safe water supply and a set of new silage pits to prepare potatoes and potato co-product prior to feeding.

PRESENTATION #5: Pamela Hodgkinson, Alberta Health Services

Pamela Hodgkinson is an Environmental and Public Health Officer with Alberta Health Services who played a role in the drive to locate the source of the *C. Bovis* infection. As part of this process, she conducted visits to the site, examined local water and wastewater management systems, conducted an environmental risk assessment and gap analysis, and interviewed feedlot staff.

The symposium was attended by cattle feeders, academics, government officials, and potato producers and processors.

In her presentation, Ms. Hodgkinson drew attention to the role of Alberta Health Services in collaborating and liaising with all government agencies involved in responding to the incident. Such agencies included the provincial labs, Alberta Environment and Sustainable Resource Development, Alberta Agriculture and Rural Development (AARD), and the CFIA.

A key part of her role is to ensure compliance and enforcement of the province's *Public Health Act* and various regulations governing general sanitation. These laws provide the Health Minister, public health officials, regional health authorities, local governments, and those in other jurisdiction with the standards and necessary tools to respond to potential public health emergencies, and include such things as up-to-date information gathering, modern inspection, and the ability to issue orders to protect public health.

PRESENTATION #6: Dr. Mark Nelson, Washington State University

In the final presentation, Dr. Mark Nelson commented on the pathways by which *T. Saginata* leads to *C. Bovis* infection, outlined measures that can be taken to reduce the risk, and concluded with a set of best practices (see *page 6).* The beginning of any *C. Bovis* incident starts with people infected by *T. Saginata.* From there, the parasite works itself into cattle through numerous vectors, including feed. For example, *C. Bovis* can be transmitted to cattle by infected field workers, a lack of on-farm sanitary facilities, the practice of spreading septic sewage on or near farmland, and inadequate sanitation at food processing facilities. But the source may not be feed related. For example, birds can carry *T. Saginata* eggs they have picked up when landing around municipal sewage facilities or open lagoons, and eggs can also be carried by insects and earthworms.

Part of the difficulty in all this is that current sewage treatments are not able to kill *T. Saginata* eggs, which are considered by many as the one organism most likely to survive current sewage processes. The survival rates of *T. Saginata* eggs in the environment can also be high. Given the right climate, eggs can survive up to 21 days on stored hay, 80 days on grass silage, and up to 200 days on pasture.

In the U.S. Pacific Northwest, much of the incidence of C. Bovis was tracked down to contaminated feed sources. The number of days that cattle were on potato co-products were found to significantly impact the prevalence of C. Bovis in Idaho, for example. With respect to the outbreaks in Washington state, at least three were suspected of coming from the use of potato co-products. Previous infections were traced back to infected farm workers, the leaking of sewage onto pasture after a flood, and fecal contamination of wet feed sources.

Dr. Nelson presented the symposium with a range options to lower the risks of *C. Bovis* infection:

1) *Vaccinate:* Vaccines are available to combat *C. Bovis,* and they are highly effective. Some reports tag effectiveness at 99%. While vaccines are effective, they are also costly. The cost is compounded by the fact that treatment cannot be targeted—the disease is difficult to detect and cattle demonstrate no clinical signs.

2) *Sanitation:* Treatment with anthelmintics is available for those infected with *T. Saginata,* but most people remain asymptomatic. As such, proper sanitation and sewage treatment, and careful handling and disposal of it, are critical. Farm workers also need to maintain good personal hygiene habits.

3) *Food inspection and preparation:* Carcass inspection at the plant typically reveals any potential problems, which can be dealt with by retaining the carcass and freezing it (-5°C for 4 days, -15°C for 3 days, or -24°C for 1 day). Beef should also be cooked to a temperature above 71°C.

4) *Feed preparation:* Research and laboratory testing showed a zero incidence of *C. Bovis* infection when potatoes were heat treated at 60°C for 5 minutes. Potatoes and potato co-product that have not been heat treated can also be ensiled for at least 21 days prior to feeding. Tests conducted on potatoes that were ensiled for one, two, three, and four weeks showed reduced egg viability (13.2% of eggs were viable after one week, 4.0% after two weeks, 0.9% after three weeks, and 0% after four weeks). Feeders do have to be careful, however, with the gelatinization of potato starch and rumen acidosis. Drying of potato co-product is not a workable option.

According to Dr. Nelson, cattle feeders should assume that any potatoes or potato co-products at the feedlot that were not heat treated during processing harbour *T. Saginata* eggs, and they should be ensiled prior to feeding.

Ryan Kasko (left) explained the methods that have been employed by Kasko Cattle Co. to reduce their risk of *C. Bovis* infection. One aspect of the mitigation strategy was the construction of new silage pits for potatoes and potato co-product (middle and right).

CFIA Factsheet:
Bovine Cysticercosis

Bovine Cysticercosis ("C. Bovis" or "Beef Measles") is a parasitic disease that afflicts the muscles of cattle. The disease is caused by larvae of the human tapeworm *Taenia Saginata.* Beef Measles is a reportable disease, meaning that all cases must be reported to the Canadian Food Inspection Agency (CFIA).

Is Bovine Cysticercosis a risk to human health? Although Bovine Cysticercosis is a zoonotic disease—a disease that can be passed between animals and humans—it does not represent a serious human health risk. However, if people consume undercooked beef containing the parasite, they can acquire an intestinal tapeworm infection.

What are the clinical signs of Bovine Cysticercosis? Infections in cattle are unlikely to produce any clinical signs. Likewise, symptoms of tapeworm infection in people are usually not apparent. If symptoms are present, they typically include abdominal pain and nausea. Less common signs can include diarrhea, constipation, dizziness, headache, increased appetite, vomiting, weakness, and weight loss.

Where is Bovine Cysticercosis found? Bovine Cysticercosis has a worldwide distribution, but is most prevalent in countries with poor sanitation and where cultural habits include eating undercooked meat. Bovine Cysticercosis is found only sporadically in Canada.

How is Bovine Cysticercosis transmitted and spread? Bovine Cysticercosis is caused by the larval stage of *Taenia Saginata* (a species of human tapeworm). Cattle become infected by ingesting materials contaminated with tapeworm eggs that originate from human feces. Bovine Cysticercosis is not transmitted directly from cattle-to-cattle nor is Taenia Saginata transmitted directly from person-to-person. In a typical cattle barn climate, the eggs are estimated to survive about 18 months, being quite resistant to a number of common disinfectants. They can, however, be destroyed by drought, since they do not survive in a very dry environment.

How is Bovine Cysticercosis diagnosed and treated? Diagnosis in cattle relies on detection of cysts during carcass inspection. Suspect lesions must be submitted to a laboratory in order to confirm diagnosis. There is no treatment for this disease in live cattle.

What roles and responsibilities exist to prevent Bovine Cysticercosis? The CFIA's National Cysticercosis Program is aimed at preventing the spread of the disease to humans by detecting and eradicating infected cattle. The CFIA meat hygiene program directs the inspection of cattle carcasses at federally registered abattoirs. All non-federally registered abattoirs must also report any suspicion of Bovine Cysticercosis to the CFIA for investigation.

How would the CFIA respond to an outbreak of Bovine Cysticercosis? The CFIA investigates all positive cases and takes the following actions:

- Potential farms of origin, as well as all premises where the animals might have lived, are investigated.
- Premises found to be infected are immediately placed under CFIA control.
- Actions such as cleaning and disinfection (C&D) are implemented to remove the source of infection.
- Cattle on infected farms are moved under license to a federally-inspected abattoir for slaughter when they reach market weight.
- Badly infected carcasses are condemned. Moderately infected carcasses are temperature treated by freezing for 10 days at -10°C to kill the parasite. Treated carcasses can enter the human food chain following the completion of temperature treatment.
- The CFIA retains control of the infected premises until the source of infection has been eliminated and there is slaughter evidence that the herd is free of the parasite.

To prevent Bovine Cysticercosis, it is important to avoid human fecal contamination of cattle feed and feeding areas, detect and treat any affected carcasses, and always cook meat properly.

SOURCE: Bovine Cysticercosis Fact Sheet found at www.inspection.gc.ca

You CAN Prevent C. Bovis.
You CAN Stop Taenia Eggs in "Wet" Feed Sources.

Avoiding human fecal contamination of cattle feed and water is the best preventative measure against *C. Bovis*. Human sewage should not be spread on farmland, farmers should ensure that they have adequate and well maintained sewage disposal facilities, and farm workers should be made aware of the disease threat and be encouraged to exercise good on-farm hygiene practices. If a farm worker or family member is suspected of being infected with *T. Saginata,* they should seek medical treatment.

Feedlots that employ "wet" feed sources such as carrots, cabbage, potatoes, and vegetable processing co-products are at increased risk for *C. Bovis* infection as the eggs can more easily survive within that feed source. While the eggs are vulnerable to hot and dry conditions, they can survive for months under wet and cool conditions. The eggs are also resistant to a number of common disinfectants. To reduce *C. Bovis* risk, feedlots can take several steps.

THINGS TO DO

- **DO** separate heat-treated feed sources from non-heat treated sources. For example, separate french fries from pasteurized potato slurry and other potato processing co-product.
- **DO** know that heat-treated feed products can be fed without ensiling if the temperatures used have exceeded 60°C (140°F). These temperatures will kill *T. Saginata* eggs.
- **DO** ensile raw potato products for at least 21 days before feeding to reduce the risk of *T. Saginata* eggs that lead to *C. Bovis* infection.

THINGS NOT TO DO

- **DO NOT** mix newly delivered potatoes or potato co-product with ensiled potatoes, other heat treated potato product, or any other types of feed.
- **DO NOT** cross-contaminate feed by using unclean loaders, trucks, or silage pits. Equipment and storage used to handle or receive raw potatoes or co-product should be cleaned before handling ensiled or heat-treated product ready for feeding.
- **DO NOT** be a potential *T. Saginata* egg source! Exercise excellent personal hygiene at all times and have adequate sanitary facilities. This applies not only at the feedlot, but also in crop fields. Spreading of septic waste on fields can be a source of *T. Saginata* eggs that can infect cattle.

Hazard Analysis and Critical Control Points (HACCP)

Hazard Analysis and Critical Control Points (HACCP) is a systematic and preventative approach to enhancing food safety. HACCP systems are designed to reduce the risk of biological, chemical, or physical hazards from entering the production process and can compromise food quality or safety.

Principle 1: Identify all possible food safety hazards and measures that can be taken to control those hazards
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Principle 2: Identify critical control points in production where actions can be taken to reduce safety hazards.

Principle 3: Establish critical limits for each critical control point. A critical limit is the limit at which a hazard is acceptable without compromising food safety.

Principle 4: Establish monitoring procedures. Make sure processes are operating within the limits at each critical control point.

Principle 5: Establish corrective actions to bring processes back on track if monitoring shows deviation from critical limits.

Principle 6: Establish verification processes. Tests and sampling determine if a control measure is operating as intended.

Principle 7: Keep records to demonstrate the effective application of the critical control points and to verify processes.

FOR MORE INFORMATION:
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