



August 2007
Volume 7, No. 7

Western Dairy News

for the West, about the West, from the West

Disease risks posed by poorly fermented silages

By Duarte Diaz, Ph.D.
and Jessie Trujillo, DVM, Ph.D.
Utah State University

Ensiled forages have for many years been utilized as a method for feed preservation. Nevertheless, the consequences of improperly fermented silage can be numerous. Dairy producers are most concerned with negative impact on production due to decreased nutritive value of the final product. Ensiled forages, however, can also play a role in infectious disease transmission, or as a primary source of a disease agent.

Insufficient lactic acid production resulting in higher silage pH facilitates growth of potential pathogenic organisms. Pathogens found in improperly fermented silages can come from different sources, fecal contamination being the primary one. Not only can feces from cattle harbor harmful pathogens, but so can those from dogs, cats, birds, rodents and other wild animals. Soils can be another important source. Finally, dead animals not disposed of or discovered can become mixed into silage and be a dangerous potential source of pathogenic organisms.

The most common infectious diseases related to poor quality silage are listeriosis, botulism, neosporosis and salmonellosis. Of these, three are transmissible to humans and thus pose significant public health risk.

Listeria monocytogenes is the causative organism for listeriosis in cattle, sheep and goats. It can also cause significant disease in humans and animals. Listeriosis is a foodborne pathogen, most commonly present in contaminated milk or cheese products. Listeriosis in humans and animals predominately affects the central nervous and reproductive systems and can cause septicemia or eye infections.

The primary way cows become infected

is through consumption of contaminated feed. Listeriosis affecting the central nervous system (Circling Syndrome) can result in irreversible tissue damage and produce clinical signs of incoordination, facial paralysis, animals walking in circles, and head pressing. Listeriosis affecting the reproductive tract in pregnant cows can result in transplacental infection and late term fetal abortion accompanied by retained placenta.

Definitive diagnosis of listeriosis is based on identification of the causative organism in affected animals, aborted fetus, or silage. Silage feeding should be discontinued when an outbreak is confirmed. Affected animals could be treated immediately with high dose antibiotics following the recommendation of your veterinarian. Early treatment offers the best chance of recovery.

Listeria monocytogenes is widely distributed in soil and can contaminate ensiled feeds. Bacteria can replicate to very large numbers in surface layers of poor quality silage where aerobic deterioration occurs and pH exceeds 5.0 (e.g., top and sides of bunker silos). Therefore, prevention of listeriosis is based on proper silage management practices to ensure effective fermentation, and minimization of soil contamination of harvested feeds (i.e. chopping at appropriate height). During feedout silage should be monitored for pH and spoiled areas, especially on the sides and top, should be discarded. Pregnant cows should not be fed poor quality silage.

Salmonellosis occurs when susceptible animals ingest the *Salmonella* bacteria. Salmonellosis is a zoonotic disease and can cause enteritis, pneumonia, septicemia and death in many different species. Only a few of the more than 2,000 different serotypes of *Salmonella* bacteria are confirmed to cause enteric infections in cattle. Bacteria

may be present in the water, soil, and in feeds including silage. Dairy cattle that ingest feed or water contaminated with feces from animals shedding the organism can result in infection. Clinical disease often presents as an acute fever progressing into severe watery, foul-smelling diarrhea possibly containing blood. Affected animals are anorexic and become depressed and dehydrated. Severe cases without good supportive therapy often result in fatal septicemia.

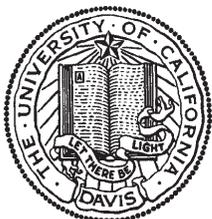
Numerous factors determine the extent of clinical disease and infection rates. These include (but are not limited to) virulence of the strain, infectious dose, age, and immune and nutritional status. Definitive diagnosis can be made by identification of the causative organism in feces or intestine and mesenteric lymph node from carcasses following post mortem examination. Several cultures may be necessary for recovery of this agent from feces.

Salmonellosis in adult cattle is usually sporadic and is associated with a stressful event such as calving. Calves are most commonly and severely affected in outbreaks. Many *Salmonella* species are recognized as having multiple drug resistance, so antibiotic sensitivity testing of recovered isolates should be undertaken prior to the initiation of oral or systemic antibiotics.

Treatment of sick animals should not only focus on use of antibiotics, but should include good supportive care to address dehydration and electrolyte losses. Segregation of affected animals is recommended to minimize spread and contamination of feed, bedding, water and soil. Although a herd outbreak can be controlled, long term problems and losses can continue due to the establishment of carrier cattle and environmental contamination.

Salmonella can survive for years in water and soil under the appropriate condi-

Western Dairy News is a collaborative effort of Dairy Specialists from:



Utah State
UNIVERSITY
EXTENSION



COOPERATIVE EXTENSION
WASHINGTON STATE
UNIVERSITY

Colorado
State
University

Knowledge to Go Places



OSU
Oregon State
UNIVERSITY

Extension Service

KSTATE RESEARCH &
EXTENSION
Kansas State University



University of Idaho
Cooperative Extension System

tions (moist, shady, cool areas of organic matter). Crops that are irrigated with salmonella-contaminated water or fertilized with salmonella-contaminated feces can lead to contaminated forages. Typically, proper fermentation in silages will suppress the growth of *Salmonella sp.*, but poorly fermented silage may permit survival and bacterial replication. In addition to cattle, birds, flies, rodents and other farm animals can be a source of contamination.

Prevention of Salmonellosis and other enteric infections is based upon feeding and management practices that focus on preventing the fecal-oral mode of transmission and minimizing introduction of salmonella-infected cattle into the herd. Rodent control and cleanliness are essential. A number of vaccines are available with variable reported efficacy in protection against Salmonellosis. If you suspect your silage is contaminated with Salmonella you should contact a veterinary diagnostic laboratory regarding appropriate sampling techniques and transport to the laboratory.

Botulism is a serious and potentially fatal toxicosis caused most commonly by ingestion of preformed neurotoxins produced by the spore-forming bacterium *Clostridium botulinum*. This bacterium proliferates in decaying organic matter (animals and plant) under anaerobic conditions. Eight types of *C. botulinum* are characterized based on the neurotoxins they produce and are the some of the most potent biological toxins known, causing disease and death in very small quantities. Nearly all animals and humans are affected by neurotoxins from *C. botulinum*; however, different animals have varying susceptibility to the different types of toxins.

Clinical symptoms associated with botulism (Types D and C are most common in cattle) include dilated pupils, decreased salivation and dry mucous membranes, progressive muscle weakness (most pronounced in the hind end as incoordination and fetlock knuckling), flaccid paralysis, recumbency, paralysis of the diaphragm, and death. Death may occur within days of the onset of clinical signs. Weakness or paralysis of the tongue and chest muscles evidenced by difficult chewing, inability to retract the tongue, and abdominal breathing are sometimes the only overt clinical signs in cattle. Watery diarrhea may be present. Suspect dead animals and feed should be handled carefully, as large amounts of potent neurotoxin may be present in rotten silage and the digestive tract of carcasses. Suspect silage should not be fed to animals.

Definitive diagnosis requires identification of the neurotoxin in serum or rumen contents of affected animals or rotten silage. It is also costly and often difficult, since consumption of very small amounts of toxins is sufficient to produce disease. Moreover, the suspect feed material is often consumed prior to the onset of clinical signs. However, identification of the type of neurotoxin present is recommended since this information is needed to administer the appropriate antitoxin to animals. Unfortunately, antitoxin therapy is expensive

and only partially effective if animals are treated at the onset of clinical disease. Exposed animals ingesting Clostridial spores in contaminated feed can shed bacteria into the environment.

Since botulism can be highly fatal and very difficult and expensive to diagnose and treat, efforts should focus on production of high quality silage that is free of soil, manure, or animal carcasses. Bacteria replicate and produce potent neurotoxin when fermentation exceeds a pH of 4.5, or when decay of organic material occurs. Proper

The negative health impact that improperly managed silages can have in a dairy herd extends far beyond reduced performance due to poor nutritional value of the feed. We must consider that these feeds can potentially harbor harmful or even fatal pathogens that can impact the health and reproduction of animals.

fermentation is mandatory to maintain pH below that at which the bacteria replicate and to minimize rot. Vaccination programs can be utilized in endemic areas.

Neosporosis is caused by the protozoal parasite *Neospora caninum* and is considered a significant cause of abortion in cattle. It is one of the most efficiently transmitted parasites in cattle. Dogs and coyotes are definitive hosts, although other species such as the opossum, fox, raccoon and other domestic and wild animals have been implicated in its spread. The definitive host becomes infected by consumption of primarily placental and fetal tissues following abortion. Cattle and many other mammalian species can act as an intermediate host. The zoonotic potential for Neosporosis in humans remains uncertain.

Cattle become infected following consumption of contaminated feed, water or tissues, or by being born to infected dams. Cow-to-cow transmission following ingestion of oocytes from infected cow feces or secretions including milk, and venereal transmission is suspected. Fetal transmission contributes significantly to persistence and

propagation of *N. caninum* within a herd. Infected cows remain infected for life and may transmit infection to their offspring, consecutively or intermittently.

Fetal and placental infection can result in midterm fetal death (between 3.5 and 8 months) with delayed fetal expulsion without placental retention. Abortion storms may occur over a period of 1 to 2 months. Aborted fetuses are often edematous and partially decayed. Weak calves with neurological signs born following a significant *N. caninum* abortion storm can be seen. Following an abortion storm the disease may become endemic in the herd, persisting for years. Diagnosis of *N. caninum* abortion can only be made following a postmortem exam on the fetus and placental tissues. Serology is only helpful in determining exposure rates among cattle.

Currently there is no treatment available for Neosporosis in cattle. Eliminating or reducing contact with definitive hosts is paramount for reduced risk of exposure or infection. Improperly fermented silage contaminated with fecal material from definitive hosts can be a source of infection. Immune suppression due to mycotoxicosis, mineral deficiencies, or infections with other bovine pathogens may accentuate abortion problems. The feeding of moldy silage (likely containing mycotoxins) has been identified as a risk factor for infection.

Conclusions:

Since most of the pathogens discussed in this article can cause significant disease in humans and treatment options are not ideal, prevention of human and animal infection or exposure is necessary. Therefore, it is imperative that silage be of high quality and people handling silages take appropriate precautions to ensure their safety.

Hygiene and cleanliness for personnel, equipment and the facility is paramount. Thorough hand washing (ideally coupled with use of gloves) should be mandatory after handling silage or animals and after performing cleansing, feeding, or milking protocols. Steps should be taken and maintained to prevent contamination of feedstuffs. Protective outer clothing and footwear should be utilized and not taken home.

Measures should be implemented to reduce environmental contamination such as 1) routine cleaning and disinfection of buildings and equipment, 2) prevention of overstocking or crowding, and 3) rotational use of land. Implementing and following these simple rules will help minimize the exposure risks to you, to farm personnel and animals, and to loved ones at home.

The negative health impact that improperly managed silages can have in a dairy herd extends far beyond reduced performance due to poor nutritional value of the feed. We must consider that these feeds can potentially harbor harmful or even fatal pathogens that can impact the health and reproduction of animals. Moreover, we must also consider that poor quality silages can pose potential public health risk to both us and to consumers of dairy products, and that awareness and prevention is key to minimizing the risk of exposure.

Western Dairy News is published as a service to people interested in the health and welfare of the Western dairy industry. Archives of this publication may be found at:

<http://animalscience-extension.tamu.edu/dairy/wdn.html>

For further information contact:

Dr. Ragan Adams, Editor
ILM, CSU-VTH
300 W. Drake Road
Fort Collins, CO 80523
970-297-0371

radams@amar.colostate.edu

Material published in **Western Dairy News** is not subject to copyright. Permission is therefore granted to reproduce articles, although acknowledgment of the source is requested.

Cooperative Extension programs
are available to all without discrimination.