V1136 (Revised)

Cyanobacteria Poisoning

(Blue-green Algae)

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Drinking water from stagnant ponds and dugouts during hot, dry weather can cause sudden death in animals.

This water can contain certain species of cyanobacteria, widely known as blue-green algae.

Toxic cyanobacterial blooms occur because of favorable conditions, including hot, sunny days and warm, nutrient-rich water. The blooms commonly occur in late summer and early autumn. Under favorable conditions, bacterial numbers multiply rapidly, doubling in one day or less.

Blooms usually do not last long. Rain, heavy winds or cooler temperatures often inhibit growth or break up the blooms, mixing the bacteria into the water body within a few days. However, under continuing favorable conditions, blooms may last for several weeks. Cyanobacteria can survive under ice and throughout winter conditions.

Blue-green algae often occurs in stagnant ponds or dugouts with elevated nutrient levels, forming large colonies that appear as scum on or just below the water surface. The formation of toxic blooms is unpredictable.

Live cyanobacteria is green and turns blue after it dies and dries on the surface or shoreline. The presence of bacteria often may be determined by a bluish tinge to the water. Concentrations of bacteria often are bluish green but may vary from dark green to brownish green, depending on the total bacterial population.

Following the production of cyanobacteria, sustained gentle winds will concentrate the bacteria on the leeward (downwind) side of the water body. Livestock and other animals usually are poisoned when they consume water containing high concentrations of the bacteria or the toxins generated by the bacteria.

Toxicity is dependent on the species consuming the water, and the concentration and the amount of water ingested. Ingestion of approximately 1 quart of heavily contaminated water has been fatal in cattle. Concentrations lethal to livestock usually do not occur on small water bodies that do not have enough wave action to concentrate the bacteria on shore.

Cyanobacteria has many different species; some species are harmless and others produce poisonous toxins. At least four types of potentially poisonous cyanobacteria are known to occur in North Dakota: *Microcystis* spp., *Anabaena* spp., *Aphanizomenon* spp. and *Oscillatoria* spp.

However, not all cyanobacteria are poisonous, and the cyanobacteria that generate poisonous toxins do not always do so. Toxins from these bacteria, termed cyanotoxins, are poisonous to nearly all livestock and wildlife, including cattle, horses, sheep, pigs, chickens, ducks, pigeons, geese, herons, songbirds, dogs, rabbits, small wild and domestic animals, and even frogs, fish and snakes. Cyanobacterial toxins are primarily neurotoxic (affect the nervous system) and hepatotoxic (affect the liver). These toxins also are poisonous to humans.

Symptoms of Cyanobacterial Poisoning

Signs of neurotoxin poisoning usually appear within 20 minutes of ingestion. In animals, symptoms include weakness, staggering, difficulty in breathing, convulsions and, ultimately, death. Animals affected by liver toxins may exhibit weakness, pale-colored mucous membranes, mental derangement, bloody diarrhea and, ultimately, death. Typically, livestock are found dead before producers observe symptoms.

Livestock that do survive cyanobacterial poisoning may lose weight and, in some cases, develop photosensitivity. Livestock that develop photosensitivity are prone to sunburns affecting lighter areas of skin, including the muzzle, udder, vulva/anus and areas with white hide. Affected skin will dry out, turn black and peel, exposing fresh, new skin.

No known antidotes are available for poisoning resulting from cyanobacteria. The best solution is to be aware of conditions that spawn cyanobacterial blooms. Under those conditions, keep cattle from drinking in areas having accumulated bacterial concentrations.

The toxicological data relating different cyanotoxin concentrations in water and effects in livestock are very limited. In a study with lactating dairy cattle, cows were provided drinking water with 1×10^5 cells of *Microcystis aeruginosa* per milliliter (mL), or a microcystin–LR concentration in water of about 9.8 micrograms per liter (µg/L) for 21 days, which is an ingestion rate of microcystin-LR of 1.21 micrograms per kilogram of bodyweight per day. Microcystin-LR is a potent cyanotoxin and toxicological data exits for this agent. No effects were reported in animal health, and no detectable amounts of microcystin were found in the milk.

Yearling beef cattle were provided a similar dose of 1×10^5 cells of *Microcystis aeruginosa* in drinking water for 28 days, at an average ingestion rate of microcystin-LR of 1.42 micrograms per kilogram of bodyweight per day, with no significant health effects and no detectable microcystins in liver tissue or blood plasma.

For human drinking water, the World Health Organization (WHO) issued a guideline value for microcystin-LR of 1 µg/L. Many countries have developed human drinking water guidelines for microcystins between 1 and 1.5 µg/L, based on lifetime exposures. For recreational water with possible exposure through contact, ingestion and inhalation, the WHO guidance values for microcystin-LR are higher (from less than 10 to greater than 2,000 µg/L) and associated with a relative probability of acute health effects.

Diagnosis

You can determining the presence of cyanobacteria in a number of ways. If you suspect concentrations of cyanobacteria in a water body, walk around to the leeward side of the water body. If any dead animals such as mice, muskrats, birds, snakes or fish are present, assume a poisonous condition exists.

A veterinarian should conduct a necropsy on deceased livestock to rule out other causes of death. If you suspect cyanobacteria, contact your veterinarian to determine which samples would be appropriate for your situation.

Microscopic examination is one way to determine the presence of potentially poisonous cyanobacteria, but the presence of the bacteria does not mean the water is toxic. Testing the water with laboratory analysis is probably the most accurate method of determining whether poisonous toxins are present. A water sample of at least 500 ml should be collected from the suspected water source after the discovery of death. Water testing only will determine if the water source contains cyanobacteria, not cause of death.

Water samples should be submitted to the NDSU Veterinary Diagnostic Lab or a commercial laboratory.

For more information on how to submit samples, contact the lab at (701) 231-8307 or visit its website at *http://www.vdl.ndsu.edu/*.

Prevention and Control

Here are some ways to prevent cyanobacteria poisoning:

- Implement a nutrient management plan or grazing management system that reduces the levels of nutrients entering the water source.
- Establish or maintain buffer strips of perennial species to reduce nutrients that contribute to bacteria and algae growth, specifically nitrogen and phosphorus.
- Create a designated drinking area where the risk of cyanobacteria is minimal. If wind concentrates the bacteria on one corner of a water body, fence that corner. Force the cattle to the windward side of the water body, where the bacteria cannot concentrate.
- Pump water from the center of the water body, where the bacteria are unlikely to concentrate, to a water tank.
- Construct drinking ponds so they are 20 feet wide by 80 feet long and 10 feet (water depth) deep. This decreases the surface area needed for multiplication of the cyanobacteria, maintains an adequate supply of water for the livestock and decreases the effect of wind on the surface of the pond.

If repeated cyanobacterial blooms occur, consider treating the water. Copper sulfate is most commonly used. Use extreme caution if considering the use of copper sulfate. Use it only in ponds that do not drain into other waterways or water bodies, and do not consume any plants or fish that may be in the pond being treated. Copper sulfate is toxic to other plants and fish and can be detected as a residue within plants and fish.

A level of 1 part per million is usually considered the upper level of treatment. This is equivalent to 8 pounds of copper sulfate per 1 million gallons of water.

The copper sulfate must be spread evenly across the water surface. Placing the copper sulfate crystals in a burlap bag and towing the bag behind a small boat until the crystals are dissolved is one method. Treatment is most effective if applied just as the bloom is forming. One treatment is usually satisfactory for two to three weeks.

Photo courtesy of the Walsh County Soil Conservation District.

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