

Blue-green algae being studied for impact on cattle

May be cause of some cattle deaths

Blue-green algae, also known as cyanobacteria, are microorganisms with photosynthesizing ability which grow in water bodies.

An increase in case submissions for algae identification has been hypothesized to be related to drought conditions that existed across the Midwestern U.S. during the past two years. In one such example, 30 out of 50 cows died shortly after consuming pond water in central Iowa. A blood chemistry evaluation of a surviving cow revealed some indications of temporary liver damage, and the pond water revealed significant numbers of *Microcystis* (toxic to the liver) cyanobacteria.

Watch for algal blooms

In Iowa, cyanobacteria blooms occur any time from late spring to early fall (June through September). For blooming to occur, the right combination of environmental conditions must exist. Peak blooms may occur during warm sunny weather with temperatures ranging from 50 to 86 degrees Fahrenheit, water phosphorus concentrations in excess of 30 micrograms/liter, and high water nitrogen content.

Some of these environmental conditions are consistent with water pollution, generally referred to as eutrophication. Not all algal blooms produce toxins, and factors which trigger cyanotoxin synthesis are not well understood at present.

Toxic species and compounds

While there are hundreds of cyanobacteria species, only a few are associated with poisonings in livestock. These species of cyanobacteria produce different kinds of toxins - microcystins and anatoxins.

Microcystins are toxic to the liver, whereas anatoxins cause nervous system disruption.

However, we are also observing an increase in a new emerging invasive species of tropical cyanobacteria known as *Cylindrospermopsis* which produce potent systemic toxins known as cylindrospermopsins. Their impact on Iowa livestock is yet to be determined.

The majority of blue-green algal intoxications are caused by microcystins. Cattle can be affected by drinking water containing toxins or intact blue-green algal cells.

In small lakes or large ponds of water, wind effect tends to concentrate the blooms on one side of the water body. Cattle are usually poisoned when they drink from the windward side of these stagnant water bodies where the blue-green algae accumulate.

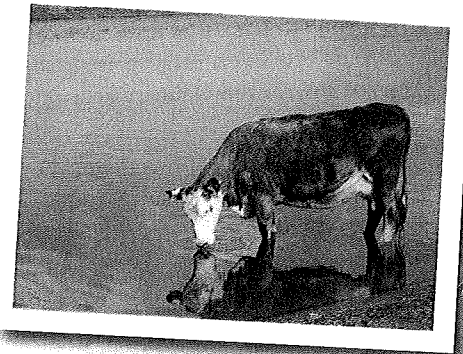
However, toxic blue-green algae also will grow in stagnant small puddles of water and in water collection vessels on farms if left uncleaned for a long time. In acute cases, affected cattle die within a few hours of exposure. In subacute cases, death may come in a day or so.

Anatoxins are the second class of cyanobacterial toxins most likely responsible for livestock intoxication in Iowa.

It is possible to have both microcystins and anatoxins produced in an algal bloom. Two common anatoxins are produced (i.e. anatoxin-a and anatoxin-a(S)). Both are potent neurotoxins. Anatoxin-a results in a very rapid (minutes to a few hours) onset of rigidity, muscle tremors, progressive paresis, and paralysis. Livestock may be found dead due to respiratory paralysis.

On the other hand, anatoxin-a(S) is an irreversible acetylcholinesterase inhibitor. Its toxic mechanism is similar to that of organophosphorous or carbamate insecticides.

Clinical signs are all related to the effects of this toxin to the peripheral nervous system and include salivation, lacrimation (excessive



tearing of the eyes), urination, diarrhea, dehydration, tremors, incoordination and convulsions. Affected animals die of respiratory paralysis. There are no gross or histological lesions in animals that have died of anatoxin intoxication. Death comes quickly, usually in a matter of minutes to hours and may occur in the vicinity of the contaminated water body.

Submitting lab samples

Proper diagnosis relies on appropriate sample selection, ideal sample size, and preservation. Improper sample submission can obscure a complete diagnosis.

If you think your cattle may be or are affected, please contact your local veterinarian to collect the appropriate samples. Your veterinarian will discuss other possible causes of disease in your herd. Most diagnostic laboratories request that the veterinarian be integrally involved in the submission process for this reason. More information on health effects of blue-green algae poisoning are online at: <http://www.cdc.gov/nceh/hsb/hab/default.htm>

Editor's note: Steve M. Ensley, DVM, is a clinician who specializes in toxicology at ISU's Vet Diagnostic Lab. He was assisted in research on this issue by Wilson D. Rumbeiba, DVM, and Douglas B. Snider, DVM.