

Identification and Management of Blue-green Algae in Farm Ponds

What are blue-green algae?

Blue-green algae include several different cyanobacteria that live in freshwater, brackish water, and salt water. Cyanobacteria can produce cyanotoxins (Figures 1 and 2) that cause adverse health conditions or death of people and animals. Toxic blue-green algae blooms are most common during the summer. These blooms are more common and longer lasting in years with long periods of hot, dry weather.

Blue-green algae can rapidly reproduce and form blooms, or large colonies. These blooms can be visible as a layer on the water's surface and may change the color of the water in a pond. Toxic blooms are often referred to as harmful algal blooms.

A pond containing a harmful algal bloom may be covered with a layer that looks like bright-green paint, but other colors are possible, varying from blue-green to grey and occasionally red or brown. Some cyanobacteria are filamentous and may form slimy strands. Blue-green algae can be distinguished from duckweed and other vegetation by size, as individual duckweed plants are visible without a microscope. To view more images of these plants, visit the United States Geological Survey website for cyanobacteria identification website: <https://pubs.usgs.gov/of/2015/1164/ofr20151164.pdf>.



Figure 1. *Microcystis aeruginosa*, a toxic species of blue-green algae.

What causes blue-green algae blooms?

The causes of harmful algal blooms are not completely understood. The causes are related to increased nitrogen and phosphorus concentrations in surface water, but the exact relationships between nutrient concentrations and blooms are complex and difficult to predict. Although agricultural nutrient runoff is a known risk factor, harmful algal blooms are also found in ponds or other surface water surrounded by rangelands or grass buffer strips, where agricultural nutrient loading is rarely an issue.

Environmental factors that favor the formation of harmful algal blooms are hot, sunny weather with little wind and little recent rainfall.

Blue-green algae bloom formation and duration is difficult to predict. Blooms may last for days or months. Cool, cloudy weather with high wind speeds can shorten the duration of a bloom. Evaluate the status of the bloom every two weeks until there is evidence the bloom has dissipated.

How are livestock affected by blue-green algae?

Most cyanotoxins produced during harmful algal blooms are stored within the cyanobacteria until they die. As the dead cyanobacteria decompose, they release stored toxins into the water. Toxins are not evenly dispersed in a pond.



Figure 2. A toxic species of blue-green algae in the genus *Anabaena*.

Microcystis species, which are typically the most problematic blue-green algae in Kansas, are buoyant in the water. They live at or near the water surface to capture the most sunlight for photosynthesis. When the wind blows in a relatively constant direction, these organisms accumulate on the downwind side of the pond, where cyanotoxin concentrations may increase. Other blue-green algae species are less buoyant and may be more widely dispersed.

Localized concentrations of toxins can vary dramatically within the same pond. Pockets of water that contain lethal quantities of toxins may be within a few feet of areas with low concentrations. It is impossible to determine if a body of water is toxic with a single water sample. Generally, if measurable toxin levels are found, it should be assumed that entire pond is toxic, and the pond should not be used for livestock or human drinking water (Figure 3).

Cyanobacterial toxins also may irritate skin, eyes, and the respiratory system, so humans and animals should avoid wading or touching the water. Some cyanotoxins may cause fish to be unsafe to consume. Fish caught from ponds with a toxic algae bloom should not be eaten.

Cyanotoxin consumption cannot be accurately predicted, so any water from a pond that tests positive for blue-green algae on microscopic examination should be considered unsafe for livestock consumption. Drinking the water or ingesting parts of the bloom can be fatal. Be aware that dogs may be attracted to the unpleasant smell of some algae blooms, which can be fatal if consumed.



Figure 3. Signs may be posted at lakes or ponds where blue-green algae have been found. Do not assume a body of water without a warning sign is safe.

What steps should I take if I suspect blue-green algae in livestock water?

If blue-green algae are suspected, collect a water sample and send it to the Kansas State Veterinary Diagnostic Laboratory to determine the presence of toxic blue-green algae. Directions for collecting and submitting water samples are at the end of this publication. Toxin concentrations can fluctuate widely within the same pond, so animals drinking from the pond may or may not consume significant levels of the toxin when it is present. The Kansas State Veterinary Diagnostic Laboratory will do a microscopic examination of the water sample first and determine if any toxin-producing cyanobacteria are present.

Determining the precise concentration of cyanotoxin in the water is not recommended due to the added cost and because toxin concentrations vary by location and time within the same pond. However, the Kansas State Veterinary Diagnostic Laboratory can do a rapid, accurate quantitative analysis if desired.

When a blue-green algae bloom is present, what should I do to lessen the risk to livestock?

If a blue-green algae bloom is present in livestock water and the potential for toxicity exists, restrict livestock access to the water for approximately two weeks, then retest the water to ensure toxic compounds are no longer present.

Copper sulfate application in surface water has historically been used to kill blue-green algae. Currently, copper sulfate is not recommended because the buildup of copper residue can last for years. Copper does not break down, but



Figure 4. Shorelines where algae collect are a good location to collect a water sample. Use care not to let the water contact exposed skin while sampling.

accumulates in pond sediment, affecting both water and plants growing nearby. Sheep are the most sensitive livestock species to elevated concentrations of dietary copper. Ponds treated with copper sulfate may actually increase the concentration of cyanotoxins as these organisms die.

Barley straw spread in a thin layer on the water's surface can be effective in mitigating blue-green algae toxins. The straw must be continually replaced as it sinks. It is unclear how this method works, and the effects on the pond are temporary.

An alternative water supply can provide livestock with clean water during an algae bloom. Alternatives include well water, rural public water supply, and hauling water. When an alternative water supply is not available, the only option may be to move the livestock to another location with access to clean water.

The duration of harmful algal blooms is difficult to predict because it is influenced by weather conditions. The condition may last from days to months. Cooler, cloudy weather with high wind speeds generally shortens the duration. Before allowing livestock to drink water from a pond that was previously determined to have a harmful algal bloom, water should be tested again to ensure toxin-producing cyanobacteria and toxins are no longer present.

Harmful algal blooms are serious threats to livestock health and can be fatal. Testing suspect water sources is important to minimize livestock loss and poor animal performance. Once the presence of a harmful algal bloom has been confirmed, the best management practice is to provide a different water source.

How should I collect a water sample to submit for blue-green algae detection?

1. Pond samples should be collected where algae concentration is greatest, generally along the pond edge on the downwind side of the prevailing wind direction (Figure 4). Inlets and coves on the downwind side where wind disturbance is minimal are good sites for collecting a sample. Look for a bloom or a patch of discolored water.
2. Use a clean plastic bottle with a screw lid to collect the sample. The bottle does not have to be sterile. A 20-ounce or 1-quart soft-drink bottle will work. Rinse the bottle with pond water before collecting the sample. Collect the sample at least a couple of inches beneath the surface of the water. Avoid touching the

water by wearing gloves while collecting samples. Blue-green algae are buoyant and will be just below the surface of the water. Include some of the pond bloom in the sample when it is present.

3. Fill the bottle with pond water, screw on the lid, and immediately place it in a cooler with ice or transport it to a refrigerator. Before shipping, seal the joint between the lid and the bottle with tape. Place the bottle in a resealable zipper bag and close the bag. Place the bag with the bottle in a box or small polystyrene foam container and surround it with ice packs. Use sufficient packing insulation and ice packs around the bottle to keep the sample cool until it arrives at the lab. Multiple bottles can be included in one shipping container, but each should be clearly marked with the site where it was collected so results can be matched with the source. Keep the sample cool until it is shipped to the lab. Although the sample can be refrigerated for a few days before submitting it to the lab, it is best to ship it the same day it is collected. Avoid collecting and shipping samples on days when they will arrive at the lab on the weekend and sit one to two days before being processed.
4. Fill the Toxicology Submission Form, including your name, preferred contact method, and contact information (phone, fax, email, or address). The submission form can be found at: ksvdl.org/docs/submission-forms/Toxicology-Submission-Form.pdf. Fill out the "Owner/Producer" section of the form. Check the "Blue Green Algae Microscopic Exam" box in the Nutrition Testing section on the right-hand side of the second page. If you are interested in the cyanotoxin concentration, check the box that says, "If positive for Blue Green Algae: Microcystin/Cylindrospermopsin Quantification." Add a brief collection-site description to identify where the sample was collected so the lab results can be matched with the sample location. Place the form in a resealable zipper bag so moisture from the ice packs doesn't cause it to disintegrate or the ink to run.

Ship the water sample to:

Kansas State Veterinary Diagnostic Laboratory
Mosier D-117
1800 Denison Avenue
Manhattan, KS 66506-5601

Results should be available within a four-day turnaround time after the sample arrives.

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