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Managing Algal Blooms and the Potential for Algal Toxins in Pond Water

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Toxic algae, blue-green algae and cyanobacteria are words that have been in the news since four cows died near Atlanta after drinking water from a pond that had a dense, toxin-producing algal bloom.

Blue-green algae (cyanobacteria) are common algae that generally float in the water column or attach to the pond bottom or a rock, piece of wood or other surface in the pond. Toxic algae is the name given to a few species of algae that produce chemicals that irritate skin, damage the liver or affect the brain. These effects can be quite serious, but generally are not.

Why do common algae suddenly produce toxic chemicals?

Dry weather is mostly responsible for the development of toxic algae conditions. During a drought, pond water volume is reduced and runoff no longer flushes the pond. Reduced water volume concentrates phosphorus and other nutrients that are dissolved in the water. Phosphorus, nitrogen, heat and sunlight allow algae to grow at a rapid rate. Certain blue-green algal species can dominate the algal population to the point of becoming a single species bloom.

Algal bloom density can increase until a thick scum resembling pea soup or latex paint forms. The color of the bloom may be light blue-green, bright green, green-brown or even chocolate (Figure 1). At this point, the danger from toxins is most apparent. Animals are in danger when they drink the scum along with water.



Figure 1. Algal scum can appear blue-green (left) or chocolate (right) in color.

Toxins form inside the blue-green algae cells and may be released into the water directly or after the cells die and are disrupted. Pond water with a small amount of toxin may suddenly have a large amount after blue-green algae is killed with an algicide or by a change in light or nutrient amounts. These events are called “sudden death,” “die-offs,” “turnovers” or “death phase.”

Chemicals produced by blue-green algae can range from relatively harmless to severely toxic. Earthy, musty odors coming from ponds or from the flesh of fish are caused by chemicals produced by blue-green algae or bacteria. This is a common and nontoxic event, though it may be unpleasant. Some chemicals are toxic to animals but not to fish or other aquatic organisms that have developed tolerances over time. Other chemicals produced by algae are toxic even to fish.

Rare but dramatic animal death occurs around the world and throughout recorded history. Georgia has escaped most of these algae-related animal death events. However, if the drought continues, we can expect more conditions that favor toxic algae and possibly more animal deaths from algal toxins.

What can be done to prevent animal deaths?

- Watch for the development of algal blooms in ponds.
- Watch animal behavior.
- Use algae control methods to minimize the chance that dense algal blooms that favor toxin production will develop.
- Control nutrients that reach the pond water to limit algal growth.
- Maintain grass buffers around the pond edge to catch or filter nutrients from animal waste or crop fertilization.
- Allow animals to water in limited areas of the pond or pipe pond water to tanks located away from the pond edge to limit manure contamination from animal access.
- If algal blooms do develop, take steps to eliminate the danger of algal toxins.

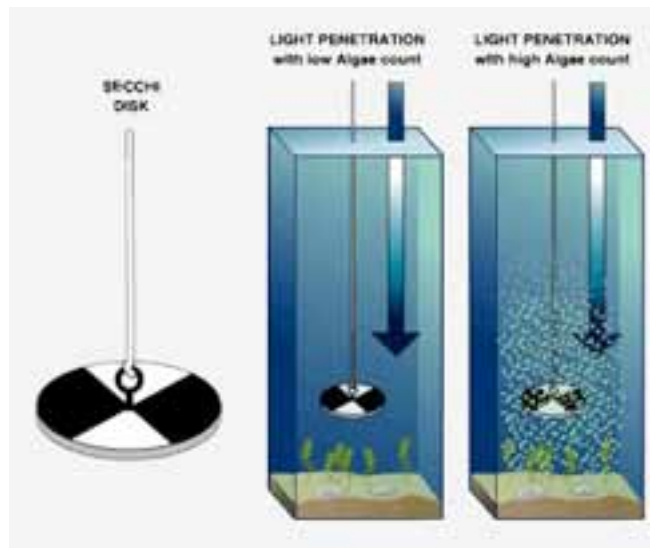
Ponds can use a certain amount of nutrient addition but when overloaded, dense algal blooms occur. However, the pond can recover and stable pond ecology can be reestablished if nutrients are kept away from the pond over time. Pond microorganisms help that process. The Natural Resource Conservation Service has published standards for constructing animal watering areas that are very helpful (http://www.nrcs.usda.gov/wps/portal/nrcs/detailfull/national/technical/alphabetical/ncps/?&cid=nrcs143_026849)

- Watch ponds with stagnant water carefully.
- Consider algal control methods when algal blooms limit visibility to less than 12 inches into the water.

If algicides are used, begin early when visibility into the water column begins to diminish. It is normal for algal density to prevent light from penetrating more than 12 inches into the water column. It is abnormal for light to penetrate less than 12 inches in depth. Use a light-colored target such as a Secchi disc or a pie plate attached to a yardstick to measure visibility into the water column (Figure 2).



Figure 2. Targets for measuring visibility in pond water.



- Flush the pond with fresh water.

If water is available, flushing the pond by exchanging more than one quarter of the pond volume per month can result in stable pond ecology even when nutrients are continually added to the pond.

University of Georgia researchers in Tifton have demonstrated that regular flushing of large quantities of water must occur when nutrients are added to ponds from processes like feeding fish or pasturing animals near ponds. Drought conditions do not allow for regular flushing.

- Consider introducing filter-feeding fish to eat algae and prevent dense algae blooms.

Threadfin shad (Figure 3) were stocked into catfish ponds to control blue-green algae in ponds at the UGA Tifton campus. About 600 threadfin shad per acre will prevent dense algal blooms in fish ponds. For the best results, threadfin shad should be stocked before the dense bloom occurs. As with most biological controls, filter-feeding



fish take time to control the algal bloom. There are some disadvantages to stocking threadfin shad, the foremost being the need to restock if the shad fail to reproduce or if they die during winter cold snaps.

Figure 3. Threadfin Shad.

- Add algicidal chemicals.

Chemicals such as copper and sodium percarbonate are the most common and practical control for algal blooms. Copper chemicals are effective on most blue-green algae and can be relatively inexpensive to apply. When used early and before dense algal blooms can develop, copper chemicals are most effective in preventing algal toxin problems. However, if copper chemicals are added when dense algal blooms develop, release of algal toxins may occur in quantities that may be toxic to animals.

Copper sulfate, added at 0.25 ppm, can effectively control blue-green algae in most ponds without killing all aquatic plants. Repeat copper application every week until visibility into the water column is more than 12 inches. Avoid applying copper more than three weeks in a row. In soft water, when hardness is measured below 40 ppm, do not use copper for the sake of protecting the fish population.

Sodium percarbonate has both an algicidal and oxidative effect when percarbonate releases peroxide as it dissolves. When sodium percarbonate kills blue-green algae and toxins are released, toxin degradation occurs due to the presence of peroxide.

Formulations of sodium percarbonate are labeled by the U.S. Environmental Protection Agency for use in pond under trade names including GreenClean, PAK-27 and Phycomycin. Sodium percarbonate has been used in fish ponds at Tifton at 16 pounds per acre-foot for control of blue-green algal blooms. However, repeated application is necessary since peroxide has a brief residence time in pond water before it degrades to oxygen and water molecules.

Any chemical addition to ponds may cause dissolved oxygen depletion. Hot weather increases the probability of oxygen depletion. An aeration source should be present before adding chemicals to reduce the danger of oxygen depletion after chemical-induced algal death.

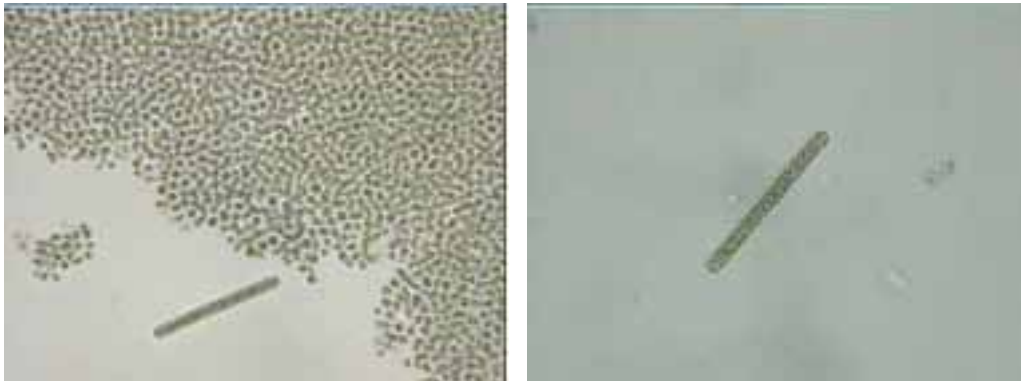
Algal toxin degradation occurs naturally from ultraviolet light exposure and bacterial degradation. Algal toxin degradation can be facilitated by adding peroxide or other oxidizers to the water. In addition to peroxide, potassium permanganate and chlorine have been used to oxidize algal toxins. Activated carbon has been used to absorb algal toxins from contaminated water.

What should I do if a pond looks stagnant?

- Take precautions against animal exposure.
- Consider moving animals or restricting access to the water.
- Install a water trough and haul good water from another source. Use water from a nearby pond with good water, from a well or buy water from a municipal source.
- During prolonged droughts, it may be necessary to sell the animals if no source of clean water can be obtained in an economical manner.
- Decide on an algal control method.

Steps to consider when evaluating a blue-green algae bloom.

1. Is light penetration into the pond water less than 12 inches?
 - Consider applying an algicide.
2. Has a scum begun to form?
 - Consider exclusion of animals until algae is controlled.
3. Is any water exchange possible from springs, runoff or water well?
 - Allow pond water to be diluted or flushed.
4. Can an algicide be applied or has one been used in the past?
 - Consider using chemical control to thin the algal bloom.
5. Would animal relocation be a good option?
 - Fence the pond or move the animals.
6. Can nutrients be excluded from the pond?
 - Create a vegetation buffer, fence out animals and control sub-surface nutrient contamination.
7. Can a temporary water supply be established for animals while the pond water improves in quality?
 - Install a water trough and haul or pipe water from a clean water source.



Microscopic view of *Microcystis aeruginosa* and *Oscillatoria* sp.

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