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**Toxic Algae** **July 5, 2012**

I've included some information from UGA scientist Dr. Gary Burtle in regards to the recent cattle deaths from "toxic algae." This is to help calm some fears and provide more clarification on what happened. If you have any questions, please contact the Extension office.

Toxic algae, blue-green algae, and cyanobacteria are words that have been in the news over the past few weeks. The story broke when four cows died near Atlanta after drinking water from a pond that had a dense algal bloom that was producing a toxin. So, what was happening? What caused the dense bloom, what could be done about it now, and what could have been done to prevent it?

Blue green algae are common algae that generally float in the water column or attach to the pond bottom or rock, wood, or other surface in the pond. Cyanobacteria is a more descriptive name for blue green algae, used by taxonomists and scientists. 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 become producers of very 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” is formed. The color of the bloom may be light blue-green, bright green, green-brown, or even chocolate. At this point, the danger from toxins is most apparent. Animals are in danger when the drink the scum along with water.

Toxins form inside the blue green algae cells and may be released into 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 to below the needs of the algae. These events are called “sudden death,” “die-offs,” “turnovers,” or “death phase.” In microbiology, growth is described in phases up to the point that the limiting parameter is depleted and the colony or population dies. Pond populations of algae can respond in a similar fashion to limited amounts of nutrients and light.

Chemicals produced by blue green algae may be relatively harmless or severely toxic. Earthy-musty odors coming from ponds or from the flesh of fish are chemicals produced by blue green algae or bacteria. That 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. If the drought continues, we can expect more conditions that favor toxic algae and probably more animal deaths from algal toxins.

We can watch for the development of algal blooms in ponds. We can watch animal behavior. We can use algae control methods to minimize the chance that dense algal blooms that favor toxin production will develop. And, if algal blooms do develop, we can take steps to eliminate the danger of algal toxins.

By controlling nutrients that reach the pond water, algal growth can be limited. 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, in order to limit manure entry from animal access. Ponds can use a certain amount of nutrient addition but when overloaded, dense algal blooms occur. However, after a period of time when nutrients are kept away from the pond, the pond can recover and stable pond ecology can be reestablished. The pond microorganisms help that process. The Natural Resource Conservation Service has published standards for construction of animal watering areas using ponds that are very helpful.

Ponds with stagnant water should be watched carefully. 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 to measure light penetration. Scientists use a white target called a Secchi disc to measure visibility into the water column. A pie plate attached to a yard stick is a good target to use for that purpose. The point of concern begins when algal blooms prevent visibility of more than 12 inches into the water. Then algal control methods should be considered.

If water is available, flushing the pond by exchanging over one quarter of the pond volume per month can result in stable pond ecology even when nutrients are continually added to the pond. Research by UGA at Tifton has 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.

Filter-feeding fish may be utilized to eat algae and prevent dense algae blooms. Threadfin shad were stocked into catfish ponds to control blue green algae in ponds at Tifton. About 600 threadfin shad per acre will prevent dense algal blooms in fish ponds. For best effect, 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.

Algicidal chemicals are the most common control for algal blooms. Copper chemicals and sodium percarbonate are most practical. 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 prevention of 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 the aquatic plants in the pond. 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 algicidal effect and also oxidative effect when percarbonate releases peroxide as it dissolves. Therefore, when sodium percarbonate kills blue green algae and toxins are released, toxin degradation occurs due to presence of peroxide.

Any chemical addition to ponds may cause dissolved oxygen depletion. Hot weather increases the probability of oxygen depletion. A source of aeration should be present before chemical addition in order to reduce the danger from 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.

For practical remediation of pond water that has algal toxin present, use sodium percarbonate. Formulations of sodium percarbonate are labeled by the US 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.

If a pond looks stagnant, take precautions against animal exposure. Decide on an algal control method. 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 if available. During prolonged droughts, it may be necessary to sell the animals if no source of clean water can be obtained in an economical manner.

Steps to consider when evaluating a blue green algae bloom include:
1. Is light penetration into the pond water less than 12 inches?
- Consider application of 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?
- Protect a vegetation buffer around the pond, fence out animals, 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.