



The Water Garden

Volume 21, Number 2

April 2004



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Green Water: Myths, Facts, Theories

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2004 Water Gardening & Pond Expo & Sale to be held April 18th

Pond product vendors and landscape and pond companies will show and sell in combination with seven seminars during the four-hour event, to be held in Mitchell Hall at DBG, Noon-4 pm. The Expo will offer everything from pond construction, maintenance, and state-of-the-art technology to water-wise landscaping beyond the pond.

Three one-hour seminars will be held in classroom "C," in the DBG main building, lower level.

Susan Yetter will present "*Echoes of Ecosystems - Interpretive Plantings Beyond the Pond Edge*" Susan is a nationally-published ornamental grass specialist who has been an instructor with the Denver Botanic Gardens certification program for more than a decade. Her business, Papa Piedra and Mama Tierra, specializes in rock projects, including retention walls and pathways.

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Official Journal of the Colorado Water Garden Society



Colorado Water Garden Society
c/o Newsletter Editor
1023 S. Kittredge Way
Aurora, Colorado 80017

First Class Mail

April 2-4
Denver Flower, Plant and Landscaping Show and Sale, Colorado Convention Center
(volunteers needed to staff booth, assist with set-up/tear-down - call 303-755-1885)

April 18
CWGS Water Gardening and Pond Expo, Mitchell Hall, Denver Botanic Gardens, 12-4 PM
(volunteers needed for CWGS table, set-up/tear-down, misc. - call 303-755-1885)

May 7-8
Denver Botanic Gardens Annual Plant Sale
(volunteers needed to sell in water garden area - call Bob Hoffman, 303-978-0124)

May 16
CWGS Mtg. - Container Water Gardens and Fountains, Morrison Ctr., 2 PM

June 6
CWGS Annual Plant Sale, Morrison Center, Denver Botanic Gardens
(volunteers needed for a wide variety of tasks both days, June 5 and 6 - call 303-755-1885)

Board Meetings are held at 12:00 pm prior to general meetings. Members are welcome to attend.

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<http://www.colowatergardensociety.org>

Upcoming Events

--- **CWGS will appear....**at the new Denver Flower, Plant and Landscaping Show and Sale at the Convention Center, April 2-4. If you are interested in sharing your knowledge for a short time at the CWGS information booth, or would like to help build the booth and/or take it down, contact Cyndie Thomas, 303-755-1885. Free tickets will be available for those who volunteer.

--- **Coming in December 2004....**an exclusive CWGS calendar featuring YOUR photographs. The photos that appear in the calendar will be selected by the CWGS Board, and all photos submitted will be put on the CWGS website. Send your pictures in digital format to:

michael.thomas@comcast.net

If you don't have a digital camera, we can scan photos and convert them to digital format. All photos become property of CWGS.

--- **Work for Spring start-up** has started at Denver Botanic Gardens. If you want an opportunity for "hands-on" learning, this is one you won't want to pass up. Work time is on Sunday mornings. To obtain start times and more information, contact Lowell Coon, CWGS Volunteer Coordinator, (303) 427-8532.

--- **Rose Swenby and Cyndie Thomas** will present "*Ponds and Water Conservation*" on behalf of CWGS at Tagawa Garden Center, 7711 S. Parker Rd., on Saturday, May 22, 1-2:30 p.m. Good tips on conserving water with a pond.



Koi Ponds ■ Waterfalls
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John and Terri Rowe
720.318.7414

fax: 303.466.1745

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WANTED

As you begin to do your spring clean-up, remember the CWGS sale in June. We can use any plants and fish you have decided to dispose of. We will remind you again before the sale, and we can even arrange to pick up your items, if necessary. If possible, all plants should be properly labeled for maximum saleability. For more information, contact Cyndie Thomas, Plant Sale Chair, at 303-755-1885.

MARKET PLACE

CWGS Members - use this space to TRADE or DONATE water garden plants and supplies. Let us know what you have too much of, don't need anymore, or would like to have. We'll put your request in the next issue. michael.thomas@comcast.net



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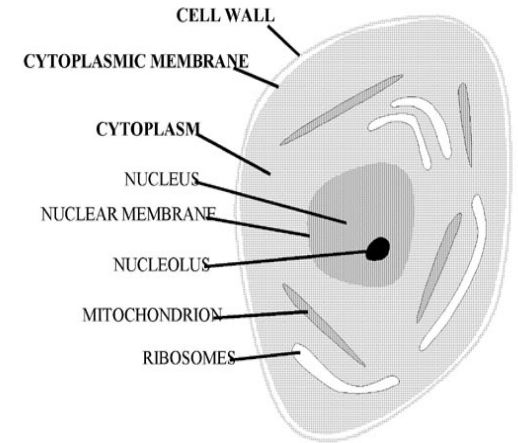
Green Water: Myths, Facts, Theories

by Norm Meck

Although it is sometimes called an algae bloom, normally the names it is called are unprintable. For some, it seems to happen every Spring (also sometimes in the Fall). For others, it is almost a way of life. A limited number of pond keepers have never or rarely experienced this "wonder" of nature. It is said that the Koi thrive in it, but you cannot see them to tell if they are thriving or not. You have heard many reasons why your water turns green and tried assorted mechanical wizardry and various chemical concoctions to clear it, (which may or may not have been harmful to your Koi), but it is still green.

There is a lot of "snake oil" out on the market to clear green water. The basic ecological relationships within even a small pond are extremely complex and the more knowledge one acquires about these relationships, the more one realizes how much is not known.

First of all, what is it? Green water is caused by an excessively large number of tiny organisms in the water. Called phytoplankton, these minute plants are part of the algae family that has thousands of distinct species found in water (and ice) throughout the world. These organisms are very small, with the most common ones found in our ponds being around 15 microns (0.0006 inches) in diameter. All pond water contains large numbers of different kinds of these plants and other microorganisms. Water that appears to be crystal clear just doesn't have as many. Although there are many different species of organisms in any pond, I have found



TYPICAL ALGAE CELL STRUCTURE

there are a very limited number of species that predominate. We will lump the most predominant into two categories and ignore the rest. The first category contains the single- (or few-) celled plants responsible for the algae blooms, which I will refer to as bloom algae. The second category will be called string algae, and consists of the multi-celled, filamentous plants that grow on the walls of the pond (and thrive on the waterfalls).

There are three ways of controlling unwanted plants, i.e. weeds, just as in your garden. They can be: starved of the necessities for life to prevent them from multiplying; removed; or outright killed. Our problem is to find a way to do one or more of these without harming our Koi (and any desired plants) that are sharing this environment. Let's review the common myths and check out the facts.

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Green Water: Myths, Facts, Theories

MYTH: Perhaps the most controversial myths involve starving the algae of the necessities of life.

FACT: Algae have specific requirements for growth just as any other plant. *Liebig's Law of the Minimum*, states that "growth proceeds only as rapidly as the least available necessity of life allows." If we can remove or reduce one or more of the required items, algae cannot flourish. Unfortunately, each species of algae has slightly different nutrient and environmental requirements. Besides the primaries of sunlight, suitable temperature, pH, and salinity ranges, all are known to need elemental Carbon, Hydrogen, Oxygen, Nitrogen, Phosphorus, Iron, Calcium, Magnesium, Copper, Manganese, Zinc, and Molybdenum. In most cases, each of these elements are required to be in an inorganic form.

Many of these are also requirements of the Koi so we can't mess around with them very much. Some of the required elements have minimum concentration values that are very small. Even if we were successful in removing a critical element, a light rainstorm or even a windy day can add more than is necessary back into the pond. Don't forget, we also go out and throw food into the pond a couple times a day. Often, an attempt to control one element will change the concentrations sufficiently to cause a different species of algae to thrive. Here are two widely believed myths that involve Liebig's Law of the Minimum.

MYTH: Providing shade over the pond will prevent an algae bloom.

FACT: It is true that algae needs light to grow and reproduce. But what is interesting is the small amount of light that is actually required. Controlled experiments using reduction in sunlight of 90% still show significant algae growth. There have been positive results reported of completely covering a pond suffering from green water with an opaque plastic cover for 5-10 days. I'm not too sure what the Koi think about this, but it is obviously not an acceptable permanent solution. I do recommend providing shade over a pond, but more for temperature stability than for algae control.

Now let's look at the myths involved with removal of these weeds.

MYTH: A mechanical filter system will remove bloom algae from the pond water.

FACT: It is impractical to remove these weeds by mechanical means. They are so tiny that they will pass through any feasible mechanical filtration device as if it wasn't even there. If the filter was fine enough to capture the bloom algae, it would plug up in minutes with the other, much larger, particulate matter in the water.

MYTH: A flocculent treatment of the pond water will clump the algae together into large enough sizes that the filter will remove them.

FACT: Flocculents only have a very weak effect on the living algae cells but can be effective in causing some organic waste and inorganic particles to clump. Further, most flocculents are alum based whose principal component is aluminum. There are no known studies of the long term effects of aluminum on Koi.

MYTH: A major water change will clear the bloom algae.

2004 Expo & Sale to be held April 18th

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"*Water Gardening Options . . . Getting Started*" will provide those just planning a water feature with an overview of all the possibilities. This seminar is being presented by Jim Wullshleger of Aquascape Design – Nursery Pro. Jim has 30 years of water gardening experience and has worked in various facets of the field; He has owned and/or managed successful garden centers in Nebraska and Colorado. He worked for Tetra Secondnature/TetraPond, and AquaMat prior to joining Aquascape Design-Nursery Pro in 2003. Jim has spoken in almost every state west of the Mississippi River on water gardening.

"*Technology in Water Gardening - Advances in Pond Design and Maintenance*" will be presented by Scott Eddy of RMAN.com. In busi-

ness since 1988, his company offers digital landscape design, construction and installation of ponds, fountains and lighting display projects.

Four shorter seminars will be held in the pavilion in Mitchell Hall. They will include: "*Carnivorous Plants for the Container or Bog Garden*" by John Bayard, CWGS; "*Keeping a Healthy Pond*," Paul & Rose Swenby, APR Landscape Co.; "*Streams and Waterfalls*," Scott Eddy, Rman.com, and "*Choosing Fish for the Pond*," Ray & Kathy Smith, Koi Lagoon.

Pause and view more water gardening and landscape ideas in a looped show on the main stage. Behind-the-scenes tours of DBG will also be given.

CWGS will be selling Lotus for \$20 each. Care & information will also be available, along with Pondtabbs for fertilizing all aquatic plants. Tickets for the drawing on the "Frog Fantasy" quilt will be available for \$1 each, or 6 for \$5. Several door prize drawings will also be held.

Seminar Schedule

12 noon - 1:00 pm - *Technology in Water Gardening - Advances in Pond Design and Maintenance* - Scott Eddy

1:30 - 2:30 pm - *Water Gardening Options ... Getting Started* - Jim Wullschleger

3:00 - 4:00 pm - *Echoes of Ecosystems - Interpretive Plantings Beyond the Pond Edge* - Susan Yetter

Mini-Seminar Schedule

12 noon - 12:30 pm - *Carnivorous Plants for the Container or Bog Garden* - John Bayard, CWGS

1:00 - 1:30 pm - *Keeping a Healthy Pond* - Paul & Rose Swenby, APR Landscape Co.
2:00 - 2:30 pm - *Streams and Waterfalls* - Scott Eddy, Rman.com

3:00 - 3:30 pm - *Choosing Fish for the Pond* - Ray & Kathy Smith, Koi Lagoon

CWGS Newsletter gets facelift, again

by Michael Thomas
 Newsletter Editor



Readers last month noticed a change in the appearance of **The Water Garden**. Comments heard since then have been favorable. The old format had been in use, with minor variations, for over 10 years, because that covers the time period I last edited this publication.

I can assure you we didn't change for the sake of change, but had some good reasons, mostly having to do with production processes and changes in technology. In short, computers and desktop publishing can do things today that couldn't be done efficiently, or inexpensively, in the past.

With this issue, **The Water Garden** has a new look, again. I hope you like it, too. Several people who saw it during production did, especially when we were able to hold on to many of the elements of last month's new design.

The format change this issue was unintended, but made necessary by several goals undertaken by CWGS this year. One of those goals included a special color supplement in the May

edition providing information on marginal plants, a wide variety of plants that can be used in a variety of ways.

Another goal was to reduce operating expenses in these times of drought and financial ups and downs. CWGS was battling monthly with its printer over the cost of publication. The special issue in May also created a price showdown that finally pushed the CWGS Board to make a major decision.

CWGS has purchased a heavy-duty color laser printer and, beginning with this issue, will attempt to do all its printing and publication in-house. Color was always extremely expensive in printing because it complicates the processing and adds labor, but this is one area where computers have really had an impact.

Also with this issue goes out another plea to CWGS members - if you want to share your knowledge, I'm always on the lookout for writers. Stories about all aspects of water gardening are in demand. If you want to share plants, or whatever, with members, use the new Marketplace to put in a quick request and see what happens.

If you run a small business, an inexpensive ad in **The Water Garden** will reach over 250 homes and businesses (a targeted market!) all over the country. Participate in CWGS - don't just JOIN! That's the FUN part of membership.

FACT: Although a major water change will temporarily remove a portion of the bloom algae, it will actually make the situation worse and the algae bloom will normally increase shortly after the water change.

Now we are left with the killing solution to look at. There are many so-called algaecides on the market (and many more not available in the U.S. due to environmental regulations). Most of those available are copper based. Although those containing chelated copper may be less toxic to fish, it has been shown that the long-term effect of copper build-up in Koi is a problem. Dosages are critical. **BE EXTREMELY CAREFUL OF ANYTHING YOU PUT INTO YOUR POND!**

MYTH: Addition of salt to the water will kill the bloom algae.

FACT: The predominant species of algae in our ponds are only slightly affected by salinity levels that can be tolerated by the Koi. Some species of algae cannot tolerate more than about 1 ppt (part per thousand) of salt in the water while others cannot survive if the salinity is less than 1 ppt. Neither of these particular species normally contributes to an algae bloom. Nothing says WE have to kill the bloom algae; how about having another creature act as a hit man for us?

MYTH: The nitrification bacteria in the biologic filter kill and eat the bloom algae.

FACT: The nitrification bacteria are chemolithotrophs, which means they use only inorganic chemicals as their energy source. In addition to their basic requirements of oxygen, carbon dioxide, and a few trace minerals, they are very

restricted to diets of only ammonia and nitrite respectively. There is another group of bacteria in the filter that one hears very little about. These are the heterotroph (chemoorganotroph) bacteria which consume dead organic matter. Technically, these organisms conduct a process called aerobic bacterial decomposition, but it is more commonly known as decaying or rotting. This is essentially the same thing that takes place in a compost heap or what happened to that fish that jumped out of the pond and was not discovered until several days later. Let's look a bit closer at the structure of these single celled plants responsible for the algae blooms. The drawing is a general example of the cell structure that would make up most types.

Examining some of the characteristics of three of the primary components of an algae cell, first is the cell wall, which is peculiar to plants (animal cells do not have a cell wall). Different plants have slightly different chemical makeup of the cell walls but, for all plants, it is a relatively-rigid layer of cellulose that strengthens the cell and provides the structural support for the higher orders of plants such as trees. The cell wall protects the very thin, highly-flexible, but structurally-weak Cytoplasmic membrane that lies under the wall and surrounds the interior of the cell. The cell interior, the Cytoplasm, consists of a solution of salts, sugars, amino acids, vitamins, and a wide variety of other soluble materials in water. Osmosis causes water to pass from outside the cell through the permeable cell wall, continue through the cytoplasmic membrane, and dilute the

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Green Water: Myths, Facts, Theories

cytoplasm. This builds up pressure within the cell until it equalizes the pressure; if not for the rigidity of the cell wall, the cell would burst.

When an algae cell dies, the cell wall structure can no longer support the pressure of the water entering the cell and the cell bursts. The now exposed cytoplasm is quite sticky and has a natural tendency to adhere to anything it might come in contact with. The internal surfaces of the bio-filter media are a natural trapping location for these cells and, combined with the oxygen-rich water, a healthy environment is provided for the growth of heterotroph bacterial colonies to decompose the dead cells.

A waste product of the decomposition process of the cell walls is an antibiotic that is toxic to algae. The presence of this antibiotic in the water causes other algae cells to die, the heterotroph bacterial colony increases in size as more "food" becomes available, and as more antibiotic is produced, more algae dies. If the limiting factor is the amount of "food" for the heterotroph bacteria, the water has relatively few remaining algae cells and appears quite clear.

Reports and preliminary experiments show that barley straw has a similar enough chemical makeup to algae that, when it is subjected to the same aerobic bacterial decomposition, a comparable, if not identical, antibiotic is produced. As more antibiotic is produced, more algae dies, providing material for more antibiotic production. This can explain why a pond

which has been green for some time is often observed to clear almost overnight. After a pond clears, a slight brownish or tea colored tint is often observed for a few days. This is believed to be due to a higher concentration of the antibiotic than normal. As the antibiotic level drops to its equilibrium level, this tint usually goes away. A large water change out will remove a significant amount of the antibiotic that is active in the pond. The bloom algae then gets the upper hand and the pond goes green until sufficient replacement antibiotic can be produced to clear it again.

The production of this antibiotic is a continuing and fairly lengthy process. If the filter media is cleaned (which removes the dead algae cells that are being consumed and removes a significant portion of the heterotroph bacteria colonies), the production rate of the antibiotic drops. The amount of the antibiotic remaining in the water decreases and we have green water again.

Often, the water will go green for a short while following a spawning. The heterotroph bacteria prefer the nutrient rich waste from the spawning and will naturally consume it prior to the dead algae cells, thus temporarily reducing the antibiotic production.

In the Spring, as the water temperature increases, the algae become active at a slightly lower temperature than the heterotroph bacteria. The algae start multiplying rapidly, giving an algae bloom and, until things warm up a bit more and sufficient time passes for the heterotrophs to get up to speed, the water often turns green. In the Fall, as the temperature

declines, it reaches a point where the bacterial activity slows down. The antibiotic production decreases, thus removing control over the bloom algae which is still active. The result is Fall green water. Dead algae cells are most often trapped near the external surface of filter media, not deep inside it. This is why a filter with a large flow area works better than a smaller one (even if it has a greater total volume of media). As the layer of dead algae builds up on the media, the outer portions of this layer isolate the underlying regions from oxygen and the decomposition (antibiotic production) process proceeds more slowly than if the material was spread out over a larger area. This is why multiple biologic filters should be run in parallel as opposed to series for maximum effect. Approximately one square inch of traditional filter cross

section flow area is appropriate for each gallon of water in a typical Koi pond. Bubble bead or similar type filters do not generally have sufficient internal surface area to support the heterotroph colonies necessary for antibiotic production. They do an excellent job of capturing the dead algae and other solids, however. During the frequent backwashing processes, the dead algae and much of the heterotroph bacterial colonies are removed from the system giving insufficient time for the antibiotic to be produced. This is why ponds using these filters almost always require an ultraviolet system to handle the green water problem. A properly sized UV system will do a good job on eradicating the bloom algae. It will not affect the string algae, only the phytoplankton that actually pass through the unit. There are also some indications that the UV radiation destroys or at least weakens any antibiotic action.

Welcome to CWGS!!

Membership Renewals

- Lynn Bartelt
- John and Mary Bayard
- Moe Belisle
- Ann Bennett
- Chris and Sue Blakeslee
- Alice Cambell
- Mike and Bonnie Collins
- Dave and Debra Foster
- Len and Doris Freestone
- Damon and Nancy Ginnow
- Betty Gray
- Larry and Janie Griffin
- Mike and Susie Hawes
- Scot Hayward
- Rick Hinrichs
- Dennis Horgan
- Jim Howell

- Trina Jacobson
- Bud and Debbi Kiebler
- Neil and Carla Littlefield
- Cathy Manley
- John and Arlyn Martens
- Irmal Miller
- David and Donna Nelson
- Werner and Nancy Neupert
- Mike and Vickie Pervich
- Les Petrash
- Chuck and Mary Purdy
- Gary and Judy Reid
- Mark and Judy Richards
- LuNelle Riggle
- Joseph and Melissa Shopnitz
- Carol Tuttle
- Marvin and Marty Umholtz
- Patricia Weis-Taylor
- James and Marilyn Wilson
- New Members**
- John and Laura Martin