

# Commercial Greenhouse and Nursery Production

## Controlling Algae in Irrigation Ponds

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Commercial greenhouse and nursery crops require large quantities of high-quality water. On average, the estimated daily water requirement is 22,000 gallons per acre for greenhouses and 27,000 gallons per acre for nurseries. Because water is so essential, commercial operations need to maintain water supplies of sufficient quantity and quality to produce plant material profitably.

Most commercial greenhouse and nursery operations have surface ponds or reservoirs for an irrigation water source (Figure 1). The water collected in these ponds or reservoirs often comes from precipitation or runoff from the facilities (Figure 2). This water can provide a suitable habitat for algae (Figure 3). When pond water temperatures increase in late spring, algal populations can become large enough to clog irrigation systems and control often becomes necessary.

A variety of control options are available to treat irrigation water at the source or as water is pumped into the irrigation system. Even growers who have been in business for a number of years without treating for algae may find it necessary to do so in the near future. If you are considering recycling irrigation water for your operation, this is especially true.

This publication is not a comprehensive review, but an initial resource for Midwest greenhouse and nursery operations that want to manage algae.



**Figure 1.** A typical Midwest surface irrigation pond.



**Figure 2.** Stormwater run-off from nurseries that enters irrigation ponds may contain algae.



**Figure 3.** Algae mats can form in irrigation pond shallows.

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## Algae Growth and Development

Algae are photosynthetic (chlorophyll containing) plants low on the evolutionary chain. Algae can occur as single-celled individuals or form colonies or mats. They can reproduce asexually by cell division, or sexually, by producing zoospore forming gametes.

In addition, algae colonies or mats can fragment into small pieces and continue to grow. Cells, fragments, and spores can easily spread through air and water, or by mechanical means. Spores germinate and cells grow under conditions where ideal light levels, moisture, and nutrients are present.

Spores and algal cells can travel via media, containers, or in any component of the irrigation system (Figure 4). So, good sanitation and maintenance practices are key aspects of algae control in greenhouse or nursery operations. Algae control begins with good production practices that include:

- Maintaining proper ventilation
- Sanitizing implements and surfaces
- Avoiding over-irrigation
- Reducing or draining areas where water collects
- Maintaining appropriate fertilizer levels



**Figure 4.** Algae growing in a facility's irrigation canal will introduce algae back into irrigation ponds.

## Factors Affecting Growth

Surface water sources almost always contain algae, so even operations that have ideal production practices may require algae treatment programs for irrigation water. There are several variables related to facilities and their production parameters that require different treatment options.

The following factors affect algae growth in irrigation ponds:

1. *Pond size and depth.* Small, shallow ponds (high light and water temperature) facilitate algae growth.
2. *Stagnant water, shallow depth.* Limited wave action and movement favors algae.
3. *High levels of nutrients, especially phosphorus and nitrogen.* These nutrients are a fertilizer source for algae.

## Change the Physical Environment

Understanding the underlying causes of any given algae problem can help you avoid implementing more expensive and continuous control programs. One of the first steps toward reducing algae problems is making physical alterations to the pond environment.

Reducing the amount of nutrients that enter the pond will be the most significant preventive step in reducing algae growth — nutrients provide the food (nitrogen and phosphorus) to support large algae populations.

Applying excess nutrients at your operation could be contributing to the algae problem in your pond. Reducing the amount of nutrients you add will not immediately solve algae problems, but will be beneficial in the long term.

*Excavated Pond Construction in Florida* (University of Florida IFAS Extension publication CIR939, [edis.ifas.ufl.edu/pdffiles/AE/AE01300.pdf](https://edis.ifas.ufl.edu/pdffiles/AE/AE01300.pdf)) describes the process of constructing ponds for agricultural use. If you have an existing pond that has considerable areas of shallow water (depths less than 3 feet are where algae obtain a foothold), it may be helpful to dredge and deepen these edges (Figure 5). While you make these changes, you will have to find an alternative source of irrigation water.

Constructing a vegetation filter strip around your pond will reduce nutrient run off, which may be significant if your pond is located adjacent to

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**Figure 5.** Ponds with eroded banks and no filter strips can lead to shallow areas that are ideal for algae growth.

agricultural production areas. The steeper the slope to your pond, the wider the buffer strip must be to slow runoff and allow infiltration. The filter strip will have the added benefit of reducing shoreline erosion.

*Vegetative Filter Strips for Improved Surface Water Quality* (University of Iowa Extension publication PM1507, [www.extension.iastate.edu/Publications/PM1507.pdf](http://www.extension.iastate.edu/Publications/PM1507.pdf)) provides the technical information necessary to make this type of pond improvement. Rip-rap (rocks or rubble along the shoreline) may help with erosion and sediment control, although without the added filtering benefit of plant material.

Assuming that the size of your pond is adequate, an aerator may help control algae populations by dispersing the algae. More importantly, aerators help precipitate phosphorus from the water. Aeration alone is not considered a viable algae control method, especially if phosphorus continues to be introduced into the pond.

### Algae Management

Despite implementing practices to reduce algae, you may still have to manage it in your ponds. There are three forms of algae control in surface ponds:

- *Physical/mechanical.* This involves raking or dredging, machine mowing or harvesting the pond.
- *Chemical.* This involves applying chemical algaecides.
- *Biological.* This involves introducing plants or animals that compete with or feed on the algae.

You may have success with a single option or a combination.

### Physical/Mechanical Control

Physically removing filamentous (mat-forming) algae offers the advantages of immediate control with no chemical residue. On a small scale this can be very effective. But for large ponds, physical removal requires expensive harvesting equipment (weed cutters).

When physically removing algae, the material needs to be taken out of the water and disposed of where the nutrients and fragments cannot re-enter the pond. Repeat physical removal may be necessary during the growing season. The collected vegetation will contain nitrogen and phosphorus and can be used as mulch. Dredging was previously mentioned under preventive measures.

### Chemical Control

Some have suggested that using barley straw can control algae. This method is appealing as it appears to be environmentally friendly. Barley straw has been used for 20 years as a means of control, but with mixed results. Rapid, repeatable results with barley straw cannot be assured, nor has it been proven effective on all types of algae.

Compounds released from the breakdown of barley in the water are algistatic, meaning they prevent growth, versus, algicidal or algae killing. The mode of action is therefore chemical. Barley straw must be added to the pond in a specific manner in late winter so that it will break down and release compounds before algae populations increase with warmer temperatures.

It may be possible to obtain up to six months of control with barley straw, and chemical controls can potentially be used in conjunction with it. The straw must be removed after a time as it adds organic matter and some nitrogen and phosphorus to the pond water when it decomposes. Aerators may improve results.

*Aquatic Plant Management: Barley Straw for Algae Control* (Purdue University Extension publication APM-1-W, [www.btny.purdue.edu/Pubs/APM/APM-1-w.pdf](http://www.btny.purdue.edu/Pubs/APM/APM-1-w.pdf)) provides a review of research and specific information on rates and application methods for barley straw in ponds.

There also are more traditional chemical means for controlling algae. Chemical controls help keep algae under control but do not prevent algae problems if conditions remain favorable. Chemicals can be

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expensive, and safety issues are involved for the applicator and for your operation if applied incorrectly.

To determine the most effective material, you should first identify the type of algae present. Filamentous (mat-forming) algae are the most common form found in Midwest ponds. They consist of long strands and can form into a mat on the pond surface. *A Field Guide to Common Aquatic Plants of Pennsylvania* (Pennsylvania State University Extension publication, [pubs.cas.psu.edu/FreePubs/pdfs/agrs110.pdf](https://pubs.cas.psu.edu/FreePubs/pdfs/agrs110.pdf)) is a good algae identification resource. You also need to make sure your pond contains algae and not other types of aquatic vegetation.

Once you decide on chemical controls, it is wise to choose an algaecide and have a maintenance program ready before very high levels of algae become established. In the Midwest, that would be from mid-April through mid June.

You must calculate the acreage and water volume of your irrigation pond before applying algaecides. *Managing Your Pond* (Indiana Department of Natural Resources publication, [www.in.gov/dnr/fishwild/3453.htm#weed](http://www.in.gov/dnr/fishwild/3453.htm#weed)) provides instructions on how to calculate

the acreage of your pond. Often, applicators apply chemicals to one section of the pond at a time to avoid large quantities of decomposing algal matter.

Chemical algaecides include oxidants and hydrogen peroxide compounds (relatively new products), as well as copper salts and other copper compounds (which have been the old standbys).

Hydrogen peroxide compounds are organic and break down into water and oxygen. These products can be as effective on algae as copper, but are much less effective on some of the more difficult-to-control species.

Copper is a heavy metal and never decomposes. Although copper builds up in pond sediment, when copper products are used at concentrations according to the labels, there have not been adverse effects. Copper can control the algae species that are present, opening a niche for copper tolerant algae. This is why preventive measures are very important.

Additionally, there are dye materials (which eventually photo degrade) that block portions of the light spectrum that algae require to photosynthesize.

**Table 1.** Available algae control materials and relevant details.

Material	Aquashade®	Copper Sulfate	Citrine Plus®, Citrine Ultra®, Earthtec®, K-Tea®	GreenClean®
Active Ingredient	12.6% acid blue and 1.04% acid yellow 23	Copper sulfate in varying percentages	Elemental copper from mixed copper ethanalamine complexes	Sodium carbonate peroxyhydrate (sodium carbonate + hydrogen peroxide)
Effectiveness (E) = excellent (G) = good (F) = fair	Filamentous (E) Branched (E) Planktonic (G)	Filamentous (E) Branched (E) Planktonic (E)	Filamentous (E) Branched (E) Planktonic (E)	Filamentous (F) Branched (G) Planktonic (E)
Relative Cost	\$\$\$	\$	\$\$\$\$\$	\$\$\$\$\$
Approximate Rate	1 quart/acre-foot	0.68-5.32 pounds/acre-foot	0.6-3.0 gallons/acre-foot, depending on product	3-17 pounds/acre-foot
Mode of Action	Blocks portion of light spectrum necessary for photosynthesis	Disrupts cell membranes	Disrupts cell membranes	Likely disrupts cell membranes and walls
Details	Use early in season before extensive growth. May not work well in shallow areas less than 2-3 feet deep.	Less effective in hard water (high Ca and Mg content). Toxic to fish at low pH. Best when water temperatures are above 60°F.	Chelated copper compounds prevent copper from precipitating out of solution in hard water. Best when water temperatures are above 60°F.	Best where water pH range is 6.8-7.8. Works at all water temperatures, but faster at warmer temperatures.
Restrictions	No water use restrictions	No water use restrictions	No water use restrictions	No water use restrictions

Before choosing a chemical treatment option, consider: the product's efficacy on target algae, accumulation of the active ingredient in the water, its effects on nontarget plants or wildlife, its practicality and safety, and cost.

Table 1 lists some of the available algaecides registered with the Office of the Indiana State Chemist and their relative cost. Each product's label provides use restrictions and application rates. Adhering to federal, state, and local laws is important to avoid crop injury or environmental damage.

Algaecide product labels can be accessed online and indicate registered uses, directions for use, and application methods. Researching this ahead will allow you to decide the approach that best suits your operation and to plan ahead for a safe and effective application.

Be aware that there are granular and liquid formulations of algaecides, formulated to be applied by shore or by boat depending on the size of your pond. Algaecides work by contact, so to work properly, the products must be applied to the areas where the algae exist. Distributing the product evenly at the correct rate early in the season is essential for control.

In Indiana, DNR fisheries biologists ([www.in.gov/dnr/fishwild/3590.htm](http://www.in.gov/dnr/fishwild/3590.htm)) have resources related to aquatic weed identification and control and a list of private applicators that offer related services ([www.in.gov/dnr/fishwild/3608.htm](http://www.in.gov/dnr/fishwild/3608.htm)).

### Biological Control

Triploid grass carp can be introduced into ponds and will feed on mat forming algae when their preferred food source is depleted. However, algae control using carp is variable and the presence of these fish will limit your potential to use copper containing materials.

For irrigation ponds, this is not a good option.

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