Barley Straw: A Potential Method of Algae Control in Ponds

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Nature of Algae Problems in Maryland

Algal growth during the spring and summer in ponds, lakes, and municipal reservoirs can pose a number of problems. Algae growing in ponds that are used for irrigation can clog pumps, block filters, and cause odor problems; uncontrolled growth is also very unsightly. Algal blooms seem to be more severe in bodies of water with high levels of nutrients, particularly nitrogen and phosphorus — such high concentrations are often the result of runoff from agricultural or waterfowl activity, suburban development or industrial sites.

Different species of algae bloom year-round in ponds, lakes and reservoirs and are a major source of concern for managers. Watershed management practices can have a long term impact on runoff into these bodies of water. For example, if lands cleared for development are not well protected, sediment and nutrient runoff can lead to algal proliferation that may in turn produce intractable taste and odor problems in potable water. Even with best management practices in the watershed, forests and riparian buffer strips take time to grow to a size that will effectively protect the lakes and reservoirs; as long as high nutrient levels are present in the water, algal blooms will still have to be controlled.

The use of barley straw to control algal growth in freshwater systems is a fairly new development. The discovery itself was accidental. According to one account, a bale of barley straw dropped from a British farmer's wagon, fell into a pond that had a severe algae problem — the algae gradually disappeared and did not return that season. The farmer reported his observations to a researcher who was investigating innovative techniques for controlling pond algae, an important issue in the United Kingdom where most bodies of fresh water are highly eutrophic and chemical controls are closely regulated.

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Traditional Control Options

Because bodies of water are managed for multiple use, consideration must be given to appropriate methods of algal control; managers must factor in the size, use, and location of the body of water. Best management plans frequently use combinations of mechanical, chemical, and biological techniques to optimize effectiveness. For example, controlling algae through mechanical or chemical means can be very costly and/or ineffective. In addition some chemicals may limit or restrict the use of the water for irrigation and other activities, while others can also eliminate desirable plants. On the other hand, mechanical control is only effective with filamentous forms.

Colorants (dyes which absorb light necessary for algal growth) may be an environmentally sound method of suppressing algae, but they are expensive, and often the colors are unnatural. Chemical treatments such as elemental copper, copper sulfate, potassium permanganate, and Diquat can also lead to problems. When applied directly to water, these materials present an even higher possibility for non-target exposure than when they are used in land-based applications. Some of these chemicals kill vascular plants, thus allowing algae to recolonize faster due to a lack of competition from higher plants once the chemical has broken down. This situation can then require multiple chemical applications to suppress the algae, thus presenting a still greater risk to non-target organisms.

Chlorination and filtration of water from reservoirs can take care of many species of algae, though *Synura* and *Anabena* spp. can present special problems: these algae release an oil that when chlorinated causes major taste and odor problems in the potable water supply.

The Use of Barley Straw

Scientists have still not determined the chemical pathways by which barley straw appears to control the growth of algae, though the active ingredient appears to be a type of phenolic compound. When straw is applied to a pond at water temperatures below 50°F, it generally takes 6-8 weeks to become effective; at water temperatures of 68°F or above, it only takes 1-2 weeks. Once active, the straw may remain effective for about six months, however periodic replacement appears to improve control.

It is reported that barley straw does not kill algae already present; rather it prevents the growth of new algal cells. In such action it functions like a preemergent herbicide. The anti-algal activity is only produced when the straw decomposes in a well-oxygenated environment.

The amount of straw needed is based on the surface area of the pond; the volume of water seems to make little difference. As a rule of thumb 100-300 pounds of barley straw (approximately 2-6 bales) per acre of surface area will provide good activity against algae. Higher rates have been shown to provide better algal control if the problem is severe; too much straw, however, can deoxygenate the water. Once the water is cleared of algae, the lowest rates of application should provide adequate maintenance control.

Barley straw is most effective when loosely applied so that water can move freely through it. A simple cage works well. Empty two-liter plastic bottles can serve as floats by tying them to a cage so that the barley straw can be kept at the surface for maximum efficiency. Multiple smaller cages are generally

better than one large one. Because barley straw is sometimes chopped more finely than other types of straw, pieces tend to float out and sink; thus control is reduced. The key is surface area — maximizing the exposure of the straw to the water while retaining it in the cage. There are reports that barley straw may be just as effective when bales are left intact, and anchored on the perimeter of the pond, so both methods appear to be useful.

Straw should be applied in the early spring and replenished at about two-month intervals. This gives the straw a chance to begin decomposition and get ahead of the spring/summer algal blooms that cause most of the problems for irrigation ponds and other impoundments.

So far there have been no negative side effects recorded. Positive results include observations of increased invertebrate populations and improvement of gill development in fish from ponds where barley straw is applied. Barley straw should be removed in the fall as a precaution against oxygen depletion from decay of straw.

Summary

Although more laboratory and field research with barley straw is necessary to confirm the reported effectiveness in algae control, information available suggests that:

1. Barley straw does inhibit certain types of algae, including *Microcystis* and *Synura* spp., which are water quality management problems world-wide. Barley straw is reported to be effective against filamentous or mat-forming algae that include a number of different species.

2. In most reported cases, barley straw has been beneficial if started early in the season and maintained throughout.

There is still some controversy over the use of barley straw: it has not been effective in certain circumstances, for instance, in nutrient-rich aquaculture ponds and in some geographic areas. However, it is inexpensive, not harmful, and is in fact beneficial to other aquatic organisms. In sum, barley straw could prove useful as part of a pond management program.

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References

Barrett P.R.F.,Curnow J.C., Littlejohn J.W. (1996) The Control of Diatom and Cyanobacterial Blooms in Reservoirs Using Barley Straw. Hydrobiologia. 340 : 307 - 311.

Gibson M.T., Welch I.M., Barrett P.R.F., Ridge I. (1990) Barley Straw as an Inhibitor of Algal Growth II: Laboratory Studies. J. Applied Phycol. 2:241-248.

Newman J. (1997) Control of Algae with Straw. Information Sheet 3. Centre for Aquatic Plant Management.

Pillinger J.M., Cooper J.A., Ridge I., Barrett P.R.F. (1992) Barley Straw as an Inhibitor of Algae Growth III: the role of fungal decomposition. J. Applied Phycol. 4 : 353-355.

Robert G.W., Liken G.E. Limnological Analyses. (1979) p. 150 - 156.

Street M. (1978) Research on the improvement of gravel pits for waterfowl by adding barley straw. Game Conservancy Annual Review. 10 : 56 - 61.

Welch I.M., Barrett P.R.F., Gibson M.T., Ridge I. (1990) Barley Straw as an Inhibitor of Algae Growth I : studies in the Chesterfield Canal. J. Applied Phycol. 2 : 231-239.

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