The Utilization Of Chara In Water Management

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INTRODUCTION

Man's increased concern with the aquatic environment has resulted in a strong need for new means of managing aquatic vegetation. One concept of management is to control undesirable plants through the use of environmentally safe aquatic herbicides and algicides and encourage the growth of desirable plants. If necessary, the latter can be introduced by various planting techniques.

Desirable aquatic plants are best described as those which tend to have the following characteristics: a) absorb relatively large quantities of nutrient from the aquatic environment, b) form a good fish habitat, c) are relatively unobtrusive in their growth patterns, d) are aesthetically pleasant to the water user, and e) are relatively simple to control. Undesirable plants are those which tend to grow rampantly, to dominate native plant life, and to be generally obnoxious to the water user.

One of the best examples of a desirable plant is the alga, chara (*Chara* spp.). It is a strong nutrient absorber, which tends to grow to a maximum height of a few feet. It also provides an excellent fish habitat (1). If left uncontrolled, however, especially in shallow water, chara can become an undesirable plant.

Hydrilla (*Hydrilla verticillata* Royle) is an example of an undesirable plant under many conditions. The latter is an extremely prolific, vegetatively propagated plant (2) which has become Florida's most serious submersed weed problem.

DESCRIPTION OF CHARA

Chara (also called brittlewort and stonewort) is a genus of aquatic plants with a wide distribution. The plants range from a few inches to several feet tall. The plant is anchored to the substrate by fine rhizoids. The plant "stems" have whorls of leaf-like branches bearing the reproductive structures. The color of the plant varies from a bright green to greyish brown depending on locality and presence of marl. A musky, skunk-like odor is produced when the plant is crushed. Chara thrives in all types of water. The plants are found in shallow water to depths over 20 ft depending on water clarity. The plants can also thrive in ponds that are completely dry part of the year.

There are several different species of chara in Florida (3). Some of the species are: *C. vulgaris, C. Schweinitzii, C. Hornemanni, C. foliolosa* and *C. fragilis.*

METHODS

The lakes and waterways of South Florida are presently in various stages of eutrophication. A variety of species of aquatic vegetation is present in varying degrees of infestation. Three types of management programs have been studied utilizing chara. These programs concern: (I) lakes infested with undesirable plants and chara; (II) lakes with little or no aquatic vegetation; and (III) lakes having undesirable plants with little or no chara present.

CASE I Lake infested with undesirable plants and chara (Lake Hilda, Miami, Fla.).

This 19-acre, sand and silt bottom artificial lake has an average depth of 14 ft with a maximum of 20 ft. Upon initiation of the water management program in June 1971, the lake was severely infested with hydrilla, naiad (*Najas guadalupensis* (Spreng.) Magnus) and filamentous algae. Other plants present to a moderate extent included bladderwort (*Utricularia spp.*) and chara.

The severe aquatic vegetation problem was brought under control utilizing selective herbicide systems. Hydrilla and naiad were controlled via the use of the dihydroxy aluminum salt of 1,2-dicarboxy-3,6-endoxocyclohexane (endothall) at the rate of 150 lb/A (13.4% a.e.). The bladderwort was controlled using either (a) the combination of 1,1'-ethylene-2,2'-dipyridinium dibromide (diquat) plus dicopper (II) dihydroxide carbonate (malachite) at rates of 3-4 gal/A and 15 lb/A respectively, or (b) with 2-(2,4,-5-trichlorophenoxy) propionic acid (silvex) at a rate of 3-4 gal/A. When malachite was used, care was taken to minimize treatment of existing chara.

CASE II Lake lacking appreciable aquatic vegetation (Lake Mary, Miami, Fla.).

This 5-acre coral silt bottom lake has an average depth of 8 ft with a maximum of 10 ft. Since the start of the program in June 1971, Lake Mary suffered from a lack of submersed aquatic plants. The lake experienced severe plankton and filamentous algae infestations. Clarity was initially 1-2 ft.

Lake Mary had been treated by the lakefront residents with copper sulfate for several years prior to initiation of this program. An initial treatment was made with malachite at a rate of 20 lb/A. A month later the lake was treated with a special slow release encapsulated form of copper sulfate at a rate of 25 lb/A ft (0.5 ppmw copper). The growth of filamentous algae was prevented for a period of about 6 months. However, planktonic alga species continued to grow. Subsequent treatments with the triethanolamine complex of copper at rates of 2 gal/A failed to control the plankton problem indicating it to be copper resistant.

In April 1972, experimental test plots were set up to determine the feasibility of transplanting chara. The plot areas were protected by window screen to keep out fish. Chara was successfully transplanted by simply dropping the plants into the water. Three plantings have since been made with approximately 100, 150, and 400 lb of wet chara. Some loss of plants in shallow areas resulted from feeding ducks.

CASE III Lake infested with undesirable plants and little or no chara (Lake Martha, Miami).

This 20-acre coral bottom lake was severely infested with naiad and filamentous algae, moderately infested with hydrilla and slightly infested with chara. Maximum and average depths were 25 ft and 12 ft respectively.

Upon initiation of the water management program in July 1971, Lake Martha had recurring filamentous algae and southern naiad infestations. Hydrilla was located only in certain bays. The major problem was the filamentous algae. The latter has been treated periodically with malachite at rates of 10 to 15 lb/A. Hydrilla has been controlled with the dihydroxy aluminum salt of endothall (150 lb/A). Naiad has been controlled with the same herbicide formulation (50 to 100 lb/A); diquat (0.5 to 1.0 ppmw perimeter areas only); and silvex (1.0 ppmw perimeter areas only).

During the past year there has been a sharp increase in planktonic algae. A chara planting program was initiated in December 1972. An estimated 900 lb of wet plant material was distributed along the shoreline about 10 to 20 ft out from the shore.

RESULTS AND DISCUSSION

As a result of the program carried out over the past 2 years in Lake Hilda (CASE I) chara has become the dominant plant species. Undesirable plants have become a minor problem. Water clarity has increased from 3 ft to 8 to 10 ft. Current management procedures are largely composed of controlling chara and epiphytic filamentous algae in swimming areas with malachite at rates of 15 to 20 lb/A.

Surveys today show that Lake Mary (CASE II) has a flourishing growth of chara. Plankton blooms have become a minor problem. Clarity is currently about 5-6 ft and is improving. The number of fish observed has increased sharply.

The water management program in *CASE III* (Lake Martha) has kept undesirable plants under control and caused a considerable increase in chara growth. The supplemental planting of chara has permitted this plant to dominate the aquatic environment. Over the past 6 months clarity has improved from 1 to 6 ft.

Water management programs involving biological (utilizing chara) and chemical controls offer several advantages. First of all, once established, chara crowds out undesirable weeds resulting in a minimum of unwanted weed regrowth and hence minimizes maintenance costs. Furthermore, nutrient removal by chara hinders growth of planktonic algae, thereby improving water clarity. Chara aids in maintaining environmental balance as well as providing an excellent habitat for fish. Chara also offers minimum interference with recreational uses of waterways. Its fragile stems do not snarl outboard motor propellers. Finally, chara is readily controlled by environmentally safe algicides.

Studies on the utilization of chara and other nutrient absorbing plants to aid in the management of lakes and waterways are continuing.

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