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EDITORIAL

THE CHEMICAL AQUATIC WEED CONTROL PROGRAM

Recent scrutiny, either justified or unjustified, of numerous pesticides should enlighten the aquatic manager as to possible happenings in the near future.

Chemical aquatic weed control programs in Florida have come into being as a result of the need for control. The use of herbicides has both economic and efficacious appeal.

Research and new technology aimed at improving herbicide efficacy while reducing the quantity used is to be applauded. Likewise, recognition and establishment of maintenance control programs have further reduced herbicide usage, water hyacinth being the prime example. Hydrilla, the number one aquatic plant problem, continues to invade new water bodies. We learned that hydrilla has benefits in terms of fish management and water clarity. Eradication philosophies have turned to management philosophies.

Biocontrols and mechanical controls are being utilized throughout the state to varying degrees. Their expanded use seems eminent, not as a result of anti-pesticide sentiment but rather due to their own merits.

Aquatic herbicides are a very necessary and valuable tool in managing aquatic plants. The data generated to provide assurances of their safety in water has cost millions, if not billions, of dollars. Understanding the aquatic environment and utilizing the proper management tools to achieve the desired results are goals of the competent aquatic plant manager.

PAUL C. MYERS
Water-lettuce
Pistia Stratiotes L.

by
Marc C. Bruner
Ecologist
USDA/ARS Aquatic Plant Management Lab
3205 S.W. 70th Avenue
Fort Lauderdale, FL 33314

Water-lettuce (Pistia stratiotes L.) is not a major aquatic weed in Florida or other areas of the United States although it can occasionally become a problem. Here and worldwide, the floating species water-hyacinth and salvinia, and various submerged species receive more attention. But water-lettuce is a component of our aquatic ecosystem, and is common enough to have appeared on the cover of Aquatics at least three times. The biology and management of this species has been studied by aquatic plant biologists, and these studies allow an assessment to be made of the problems and potential of water-lettuce.

Identification of water-lettuce, also known as Pistia, is not difficult. Anyone who has experienced the problems of identifying watermilfoils or potamogeton can appreciate that fact. This species, the only one in its genus, was first described by Linnaeus in 1753. A member of the Arum family, this monocot shares the aquatic habitat with several other genera in the same family although no others have a free floating life form. Water-lettuce has been recognized, identified and utilized (as an herbal medicine) since the time of ancient Egypt.

The leaves of Pistia grow in a rosette, resembling a head of lettuce. The growth form is dependent on population density. Plants in tightly packed mats have many leaves growing almost vertically, while uncrowded plants have a much flatter and spread-out appearance. The yellow to gray-green leaves are covered with a dense layer of hairs. This pubescence creates a water repellant layer which helps keep the plant from being wetted, keeping it upright and afloat in heavy rainstorms. The spongy texture of the leaves is due to aerocymma. This is tissue composed of large thin-walled cells filled with gas. The stem from which the leaves arise extends a short distance below the water surface. The roots originate from this portion of the stem. These roots are unbranched and fibrous and can reach significant lengths. They are the site of nutrient absorption.

The flowering structures are small and inconspicuous, with both male and female flowers occurring on the same plant in the hollows of the leaves. The size of the whole flower structure is less than 2 inches long. Several male flowers are borne on a thick fleshy stalk above a single female flower. Seed production has not been observed in Florida. Experimental work has indicated that where seeds are produced, they can tolerate cold temperatures and drought, and may be important in long term survival and re-establishment after removal of mature plants. The primary means of reproduction in water-lettuce is the formation of daughter plants as buds or on stolons arising from the parent plant. This growth form leads to the formation of mats of plants, which can be the source of management problems.

The distribution of this species is mainly tropical, with some extensions into sub-tropical regions. Pistia is found throughout the tropics with the exception of some of the Pacific Islands. The center of this distribution is uncertain due to man’s role in disseminating the plant. The tropics experience most of the problems associated with nuisance growth. In the United States the plant is found through the Gulf States, with additional reports from Arizona. Water-lettuce was most likely introduced to North America for use as an ornamental.

A series of problems is associated with undesired growth of Pistia. The reproduction of the plant by stolons leads to the formation of dense mats. These mats can become extensive. In still or slowly flowing water, like that found in the large tropical reservoirs, or sluggish canals in subtropical or tropical regions floating islands can form, hindering navigation. Plant mats covering canal surfaces may impede water flow for flood control or irrigation. Water loss from a mat of actively transpiring Pistia may be great enough to reduce water levels. These mats or islands can also have a marked effect on water quality, with research results indicating lower light penetration, dissolved oxygen and pH under dense water-lettuce mats. This may adversely affect fisheries.

A potentially serious problem is the association of several species of mosquitoes. Two genera of mosquitoes (Mansonia and Coquillettidia) are known to utilize water-lettuce as a host plant. These associations are so close that aquatic plants are essential for the life cycle of the insects. In several areas in Florida, the mosquito problems associated with aquatic plants have been severe. Reducing or eliminating Pistia and other aquatic plants controls the mosquitoes.

The management of water-lettuce, like most aquatic weeds, relies on mechanical, chemical and biological control methods. Mechanical control is often limited, with most management resulting from manual removal. The reason for this is that many of the areas with problems with water-lettuce are in the Third World, with relatively abundant and inexpensive manpower and little or no money to invest in mechanical harvesters.

Chemical control of water-lettuce is effective. Diquat is commonly utilized and its efficacy against this plant has been known since the early 1960’s. Treatment rates of 1.0 to 1.5 pounds per acre have proved satisfactory. Paraquat at 0.18 pounds per acre and aqueous ammonia at 44 pounds per acre were used to control Pistia in fishponds in India. These treatments were more economical than the usual methods of manual removal used in that location. The extent to which chemical control technology is applied may sometimes be small due to the limited extent of nuisance water-lettuce growth in areas where chemical control is a common approach.

Biological control with herbivorous insects appears to hold great potential. Worldwide at least 23 species of insects have been reported to be associated

Continued on page 14
A body of water is a living thing...

A delicate balance of plant and animal life. A varied assortment of creatures, many too tiny to see. A place to make peace with the world, and enjoy the wonders of nature.

But all this can change quickly. A slight shift in the environment and a tiny group of plants may suddenly burst into a teeming mass of choking weeds and slime. The effect is dramatic, as fish and other life forms struggle for survival in this hostile new world.

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Public Funded Aquatic Plant Control Operations in Florida

by J. Michael Dupes and Michael J. Mahler

In the State of Florida the majority of aquatic plant control operations are funded under two separate programs. One program is funded by the Federal Government and is the original Aquatic Plant Control Program (APCP) authorized by Section 302 of the River and Harbors Act as amended on 3 March 1905. The other program is funded under two separate programs. One is the Removal of Aquatic Growth Project (RAGP) authorized by Section 302 of Public Law 89-298 dated October 1965.

Under the Federal program, control operations are performed under two authorizations. One is the Removal of Aquatic Growth Project (RAGP) authorized by the River and Harbors Act as amended on 3 March 1905. The other is the Aquatic Plant Control Program (APCP) authorized by Section 302 of Public Law 89-298 dated October 1965. The RAGP is funded 100 percent by the Federal Government and is the original operation and maintenance program for the control of aquatic vegetation in Federal navigation projects. The APCP is a cooperative program for the control of aquatic vegetation in other public navigable water bodies not included in the RAGP. This program is funded 70 percent by the Corps and 30 percent by the state or local governments.

The majority of aquatic control operations are handled under contract with the Florida Department of Natural Resources, which in turn has subcon-}

<table>
<thead>
<tr>
<th>Watershed</th>
<th>Floating</th>
<th>Hydrilla</th>
<th>Minor Plants</th>
<th>Total</th>
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<tr>
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<td>8,819</td>
<td>359</td>
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<td>1,391</td>
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<td>1,894</td>
<td>30</td>
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<td>Ala-La-Manatee</td>
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<td>-</td>
<td>224</td>
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<tr>
<td>Lake Istokpoga</td>
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<td>710</td>
<td>2</td>
<td>2,297</td>
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<tr>
<td>Suwannee-Santa Fe</td>
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<td>214</td>
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<td>Peace River</td>
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<td>Hillsborough River</td>
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<td>-</td>
<td>4</td>
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<td>Myakka River</td>
<td>250</td>
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<td>East Coast</td>
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<td>-</td>
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<td>Auxilla-Wacissa</td>
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<tr>
<td>Lake Trafford</td>
<td>6</td>
<td>224</td>
<td>-</td>
<td>230</td>
</tr>
</tbody>
</table>

**TOTAL** 28,320 11,864 1,637 41,821
GOOD NEWS FOR AQUATIC WEED FIGHTERS:

Nalco-Trol® and Nalquatic® are good news for the aquatic weed control specialist. Bad news for troublesome aquatic weeds like hyacinth and hydrilla.

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2901 BUTTERFIELD RD., OAK BROOK, IL 60521
Plant Management in Farm Ponds
by Joe Hinkle
Regional Biologist
Fla. Dept. of Natural Resources
Bureau of Aquatic Plant Research & Control

I. Introduction
In North Florida, considerable recreational and agricultural benefits are provided to the landowner by farm ponds. The majority of these ponds are utilized to produce fish while also providing a convenient "swimming hole." A typical farm pond is less than ten acres, either artificially created or a natural cypress pond, and is usually stocked with largemouth bass, bluegill and redear sunfish. Some of the very small ponds (less than one acre) are stocked with a single species, such as channel catfish or hybrid bream.

II. Preventative Measures
Although herbicides and mechanical control can provide a good short-term solution to a weed problem, the best aquatic plant management strategy is to discourage the plants from becoming a nuisance by proper location, design and construction of the pond. The pond should be built in the shape of a rectangle with the long axis directed with the prevailing winds. This orientation will not only help aerate the pond but discourage floating plants such as duckweed from becoming a problem. Similar problems with floating plants can occur if the pond is located where trees or the lay of the land block wind action on the water. To avoid vegetation problems along the edge of a pond the sides should drop off sharply to a minimum of two feet; preferably three feet. Existing ponds which have weed problems can be deepened in many cases to alleviate shoreline vegetation problems. Woody vegetation and brush should be removed from the bottom and brush and trees removed from the side for a minimum distance of 20 feet to prevent shading and to reduce the introduction of organic matter into the pond. Centipede grass planted along the edge will prevent erosion and discourage establishment of troublesome aquatic grasses such as torpedo grass.

Areas which have excessive water flow such as small streams or springs do not usually make good locations for ponds. High water flows decrease the effectiveness of fertilization programs and herbicide treatments and increase the cost of management techniques. A pond may also receive an excessive flow due to an exceedingly large watershed for the size of the pond. A general rule-of-thumb is about 10 to 20 acres of watershed per acre of pond.

The capability to draw down the water in a pond is a very desirable feature to include in construction. In many cases successive winter drawdowns have the capability to control most of the submerged aquatics and also avoid the use of expensive herbicides. Normally, summer drawdowns, or drawdown of ponds which do not have the capability of being dewatered to a minimum two-thirds of their normal level, should be avoided. An outflow system which allows water to be removed from the bottom of the pond rather than near the surface is advisable because this removes the less oxygenated water and organic matter from the bottom, leaving the planktonic algal food source near the surface.

One means of discouraging troublesome aquatic plants and filamentous algae is through a good fertilization program. Fertilization produces a planktonic algal bloom which shades-out submerged aquatic plants. This program is usually begun in North Florida around February or March when the water reaches 65°F. An inorganic fertilizer such as 8-8-2 is normally required to increase the water fertility enough to support a good plankton bloom. A secchi disc reading of 18-24 inches is a good indication that a proper bloom has been obtained. The pH of the pond should be checked before fertilization to determine if lime is required. If the pH is below 6.5, agricultural lime can be utilized to correct the acidity problem. Lime is usually applied throughout the pond in the fall because it normally takes two to four months before a significant quantity goes into solution, thus making it available at the same time as fertilization. The pond bottom should be limed at
AQUATIC HERBICIDE BREAKTHROUGH

Sonar EPA Experimental Use Permit No. 1471-EUP-67
Sonar® gently puts the balance back in nature.

At last there's a new generation aquatic herbicide that manages a host of undesirable vascular plants without mismanaging the good life. Sonar® from Elanco.

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One treatment of Sonar provides control during the critical growing season of many submersed and emersed aquatic weeds. Weeds controlled include hydrilla, elodea, water milfoil, pond weeds, torpedograss, paragrass, southern naiad and numerous other troublemakers.

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Four to six weeks after treatment, Sonar takes its toll on undesirable vegetation. And because of its slow action, there is no rapid oxygen depletion. This makes Sonar highly compatible with the aquatic environment and makes fish kills a thing of the past. Applied as directed, Sonar will not harm fish.
wildlife, or nearby trees and shrubs.

**Flexible application.**
Sonar can be applied to the entire surface of a pond or up to ten percent of larger bodies of water. Depending on existing equipment and user preference, Sonar is available as an aqueous suspension or 5% pellet and can be applied any time during the year. For best results, the label recommends applying Sonar when weeds are actively growing.

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There are few restrictions after application, and they are detailed on the product label. Make Sonar part of your management program. It’s the simple, gentle way to put nature back in balance.
Sonar® aqueous suspension can be applied to the water surface or under the water surface or placed along the bottom of the water just above the hydrosoil. Any conventional application equipment can be used.

Sonar 5% pellet can be applied to the water surface from the shore or from a boat. Refer to the Sonar label for complete application instructions.

Always follow label directions. Sonar is available in limited quantities under EPA Experimental Use Permit No. 1471-EUP-67.

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David P. Tarver, Aquatic Specialist, 2416 McWest Street, Tallahassee, FL 32303 (904) 386-8533

Elanco Products Company, A Division of Eli Lilly and Company, Indianapolis, IN 46285, U.S.A.
A typical sheltered pond which has already developed a healthy duckweed growth due to the restriction of wind and wave action.

Plant Management continued from page 8

a rate of about one ton of agricultural lime per acre. Agricultural lime can also be used to decrease toxicity of copper based herbicides.

When utilizing fertilization as a means of aquatic plant management, two important points should be kept in mind:

1. Once started, a program of fertilization must be carried out on a regular basis or it will cause more problems than before.

2. Troublesome aquatic plants and filamentous algae must be removed before the program is started, or the plants will increase their densities due to the added nutrients.

Another important factor in preventing aquatic vegetation problems is controlling the introduction of plants into the pond. Non-native (exotic) plants such as hydrilla, water hyacinth, alligator-weed and Eurasian watermilfoil should never be introduced into a pond because they can easily become a severe problem. These exotic plants are not subject to the normal checks and balances as those of native species and as a result are able to dominate the pond, upsetting the entire system. Hydrilla, one of the most common introduced plants, can thrive under lower nutrient concentrations and lower light levels and has a higher growth capacity than native plants. If you allow neighbors and friends to utilize your pond, make sure they do not introduce into the pond vegetation on boat trailers, in minnow buckets or by fish from another lake (this is also a bad fish management practice). In both public and private waters, the spread of plant problems from one body of water to another is the direct effect of not removing vegetation from trailers, boats, motors, fishing plugs or anything else that will allow the plant to be transported to a new lake.

III. Common Plant Problems

If you have a weed problem, the first step is to identify the plant that is causing the problem. The easiest method of accomplishing this is to consult one of the DNR regional biologists or the Botany Department of a nearby college. Although there are many species of plants present in Florida ponds, very few are a nuisance.

In the Suwannee River Watershed, the most common floating plant problem is water hyacinth, with duckweed a close second. Many of these hyacinth infested ponds were controlled under the old Corps of Engineers eradication program, but with cessation of this program, hyacinths have gradually recurred as a problem. Duckweed problems commonly occur where there is a blockage of normal wind and water action due either to bank vegetation or pond location.

The most common nuisance emersed plant problems include the various water-lilies: American lotus, fragrant water-lily, spatterdock and watershield. The majority of these occur in old natural cypress and buttonbush ponds which have fluctuating water levels. Occasionally problems with alligator-weed, water primrose and frog's-bit occur. In very shallow ponds, members of the sedge family, such as hairgrass (Eleo-
United States, a moth, *Samea multipli-
calis* feeds on *Pistia*. The role of the moth in controlling the growth and spread of water-lettuce in the U.S. has not been rigorously studied, but it has been reported that control can be very effective at certain times. This insect is not host-
specific, and feeds on at least four other species of aquatic plants. A weevil has also been found in South America, which appears to be host-specific for water-lettuce. A number of potential insect agents have been found in the Far East.

Like many species that cause problems as weeds, there has been interest in utilizing the growth of this plant in a managed system. Water-lettuce has been investigated for its potential as animal fodder, and appears to be as good a source of feed as any one of a number of other aquatic plants, and perhaps better than water-hyacinth as hog feed. While this use may not be of major interest in developed countries, it may be of value for Third World countries where manual removal may be a significant weed control technology and less money is available for investment in animal feed.

There is a serious effort underway to tap the energy embodied in aquatic plants as a fuel source. Methane generation is a common approach, and studies of biomass conversion often include water-lettuce. Although it is not as productive as some other species, the quality of biomass produced by water-lettuce favors a rapid rate of methane production. Biomass production using aquatic plants may be combined with a sewage treatment process, in which the plants are used to remove nutrients from the effluent as a biological filter.

Water-lettuce is an aquatic plant with both positive and negative potential. As management of water-hyacinth improves, water-lettuce may become more common and more of a problem. If this happens, the possibilities for both chemical and biological control of water-lettuce are good. As integration of aquatic plant management and the technology of utilization improve, water-lettuce may prove to be an asset in some situations.

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**Public Funded Operations continued from page 6**

(5,651 acres); and 15% submersed (8,375 acres). Chemical control accounted for 85% (47,995 acres) of the control operations. The types and amounts of herbicides used in both programs are shown on Table 2.

The combined acreage of aquatic vegetation controlled in both the Federal and State programs during FY-81 totals 71,984 acres. Since ditchbank work is primarily terrestrial, it is not included in this total. This acreage figure represents only 2.6 percent of Florida’s 2.8 million acres of fresh water. The actual cost for the combined programs for FY-81 was $11.5 million. This includes administration costs, personnel salaries and benefits, equipment rental, as well as herbicide costs. Aquatic herbicide costs were approximately $3.2 million. An additional $700,000 was spent on chemicals for ditchbank work which were not applied directly to the water.

The acreage and cost figures presented here represent only the work performed under the Federal and State programs. They do not include work performed in other public waters by the private sector or work performed by the small agencies not participating in either program. Therefore, the amount of vegetation controlled and total cost for aquatic plant control operations in Florida will be somewhat higher. There has been much speculation about the extent of aquatic plant control operations in Florida, with some estimates as high as 40 percent of the total fresh water acreage in the state being treated. Cost estimates have been quoted to be $35 million.

In conclusion, aquatic herbicides utilized in public waters are labeled by the Environmental Protective Agency, and as such have cleared a stringent toxicity and environmental impact screening process to insure the safety of their use in public waters when properly applied. Based on this fact and the information presented above, it is felt that much of the recent concern over the perceived magnitude of aquatic plant control operations in terms of acreage treated, dollars expended, and quantity of herbicides used is unjustified.

**Table 2.**

<table>
<thead>
<tr>
<th>Herbicide</th>
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<th>State Program</th>
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<td>Invert Oil</td>
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<td>Polymers</td>
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<td>CuSO4*</td>
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<td>Ammonia*</td>
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</table>

*Note: Amounts of herbicides with an asterisk are in pounds, all others are in gallons*
Center for Aquatic Weed Research

Dr. Arnett Mace has recently stepped down as director of the Center for Aquatic Weed Research at the University of Florida. Dr. Mace was appointed as director approximately three years ago when he joined the University faculty as dean for the School of Forestry and Conservation. Dr. William Haller has been appointed as interim director until such time that a screening committee can review all applicants and make a recommendation on a permanent appointment.

Dr. Mace will remain as chairperson of the Aquatic Plant Advisory Council, a role in which he has been very active. The Florida Aquatic Plant Management Society expresses its appreciation to Dr. Arnett Mace for his efforts and contributions to aquatic plant research and the development of the University's Center for Aquatic Weed Research.

Aquatic Plant Advisory Council

The Department of Natural Resources has selected Mr. Paul Myers as their appointed representative to the Aquatic Plant Advisory Council. Paul will succeed Mr. Harold Brown who recently resigned from the Council after two years of service. Harold was elected by fellow council members as chairperson during its first year. Harold's personal effort and interest in the establishment of this council were vital to its success and recognition.

Paul's willingness to accept this extremely important role will undoubtedly benefit the aquatic plant management program.

Nominations do not have to be by supervisory personnel. We will accept nominations from any society member who feels they know a deserving nominee. In your nomination, please specifically address the following questions:

1. Does the nominee receive any complaints from home owners, etc. with respect to his routine weed control operations?
2. Does the nominee receive any special compliments from home owners, etc. with respect to his routine weed control operations?
3. Does the nominee work in any particularly sensitive areas, i.e., environmentally sensitive, politically sensitive, etc.?
4. Public relations ability, i.e., can the nominee satisfactorily explain to a "concerned citizen" the importance of his job and the environmental safety of the operation?
5. What is the nominee's background, i.e., experience in aquatic plant management or related fields?
6. Does the nominee have a broad knowledge of aquatic plant management, i.e., weed identification, chemicals, biological controls, etc.?
7. Does the nominee respect and care for equipment?
8. Innovative ability, i.e., ability to improve and modify equipment and techniques?
9. Does the nominee keep abreast of current advancements in aquatic plant management technology?
10. General enthusiasm toward aquatic plant management.
11. Any other information you can offer concerning the nominee deserving the award.

Please send all nominations to:
Jim Wilmoth
Rt. 1, Box 963
Palatka, Florida 32077

Thank you,
The Awards Committee

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Southern Mill Creek PRODUCTS COMPANY, INC.
TAMPA • MIAMI • ATLANTA
Submersed aquatic plant problems include hydrilla, naiad, coontail, fanwort, and watermilfoil (usually variable-leaf milfoil). As with water-lilies, the majority of these occur in the older natural ponds which in many cases have low hardness and pH. Hydrilla problems are usually encountered in ponds located in populated areas.

**IV. Evaluation of the Problem and Selection of Control Measures**

After identification of the problem "weed," the next step is to determine the best type of control measure for the particular pond. Factors which need to be considered include pond usage, acreage of vegetation present, and physical-chemical characteristics of the pond. The most important factor is pond usage. This will dictate how much control is needed and what kind of control to use. The basic types of plant management available to the Florida farm pond owner include mechanical, biological, and chemical control.

Mechanical plant control machinery has little application to farm pond situations with the exception of actual hand removal or cutting by hand or with a mower. Most commercial equipment is too expensive to lease or buy and can not be maneuvered in a pond. An exception is the use of cycle cutters to control lilies in the larger, natural ponds. Improved versions of the hand technique include use of a standard power mower to cut grasses to the waterline and out to about two feet from the shore. Small acreages of cattails can be controlled with repeated cuttings using a machete. Mechanical methods avoid the use of chemicals but are labor intensive making them unattractive to most pond owners looking for a quick and easy solution.

Biological control, although excellent in theory has very little application to pond owners at the present time. The major drawbacks of this method are the long duration before control can be obtained, and in many cases adequate control is never obtained. If the pond owner could recognize a problem before it becomes severe, biological controls such as the alligator flea beetle and the water hyacinth weevil would be of considerable value in pond management. The grass carp, although illegal to use in Florida without a permit from the Florida Game and Fresh Water Fish Commission, is a highly effective control agent in farm pond situations. A sterile hybrid carp obtained by crossing the exotic big head carp and grass carp is currently being researched to determine its feasibility as a weed control agent.

Of the methods available, aquatic herbicides have the greatest potential to control the various aquatic plant problems in farm ponds. All E.P.A. approved aquatic herbicides are generally safe and effective when applied according to label directions after developing a use management plan. In some instances complete control of all weeds is desired because the pond is used exclusively for swimming. A herbicide such as simazine can be applied which controls algae and many vascular plants. However, there are severe restrictions on irrigation and watering livestock. In the other extreme, a pond used only for watering livestock requires no weed control activities.

A good example of a pond managed exclusively for swimming by the use of a non-selective herbicide.

Most ponds are primarily utilized for fish production with minor emphasis on swimming or livestock watering. In most cases if water usage conflicts with herbicide label recommendation, this usage can be temporarily stopped long enough to allow significant weed control.

Water hardness, turbidity, temperature and oxygen levels are important water chemistry parameters to consider before utilizing herbicides. Copper based herbicides have increased activity on vegetation at a hardness below 50 parts per million. These products are also more toxic in "softwater."

The effectiveness of the herbicide diquat when used for submersed weed control can be drastically decreased by the presence of mud or clay particles in water. If a pond is normally muddy, a herbicide other than diquat should be selected for the control problem. Temperature also plays a factor in herbicide selection. Herbicides such as simazine are not recommended for temperatures above 75 degrees due to rapid plant die-off and corresponding low dissolved oxygen levels. If a considerable portion of the pond is to be treated at any one time it is advisable to conduct oxygen measurements to determine if levels are significant to offset the oxidation of dead plant material. These samples should be checked at dawn to get the best indication of the lowest oxygen levels which will be present in your pond.

Once a herbicide has been selected the acreage of vegetation to be treated and average depths of water need to be determined to select the proper applica-

Continued on page 18
DIQUAT clears out water weeds from top...

...to bottom.

Water weeds that clog Florida's waterways are sunk when treated with ORTHO DIQUAT Herbicide-H/A. DIQUAT is a broad spectrum herbicide that kills both floating and submerged weeds—even the tough ones like hydrilla, water lettuce and water hyacinth. And DIQUAT works fast—in just a few days after application you can see dramatic results.

DIQUAT interrupts photosynthesis in plants. And DIQUAT is economical to use. It can be used to spot-treat small areas, or control larger infestations. When surface spraying, apply with ORTHO X-77° Spreader for best results.

Licensed applicators: see supplemental label for complete details.

ORTHO DIQUAT. It sends water weeds straight to the bottom.

DIQUAT Herbicide-H/A
Plant tvlanagenient

Subject 	 Source
alarmed if fish avoid these areas for up to
start from the shore and work out to
a week. If you have fish bedding in cer-
areas can be controlled by using one of
open water allowing the fish to move out
control garden pests and plants in ponds.

Pond Fertilization Florida Game &

One-third) at any one operation. Do not
trap fish with your treatment program;
treatment should not consist of more
than one-half of the pond (preferably
separate sprayers should be used to
problems themselves. Granular herbi-
costly than liquid herbicides, do not re-
require special application equipment and
and are available to control most submerged
plants with copper liquid formulation,
granular copper formulation or soluble
powder can be effective and easily ap-
plied by most farm pond owners. However,
copper does not degrade, it merely precipitates out into the bottom
sediments.
The floating plants, hyacinths and
duckweed, are probably the most diffi-
cult for the pond owner to treat. Small
areas can be controlled by using one of
the pump-up hand sprayers or one of the
ultra low volume battery powered hand
sprayers. To avoid contamination prob-
lems, separate sprayers should be used to
control garden pests and plants in ponds.

In general, most treatments should be
directed on a clear sunny day and
treatment should not consist of more
than one-half of the pond (preferably
one-third) at any one operation. Do not
trap fish with your treatment program;
start from the shore and work out to
open water allowing the fish to move out
away from the herbicide. Do not be
alarmed if fish avoid these areas for up to
a week. If you have fish bedding in cer-
tain areas, delay treatment until they go
off the beds.

Listed below are sources of informa-
tion available on pond management
from various government agencies:

<table>
<thead>
<tr>
<th>Subject</th>
<th>Source</th>
</tr>
</thead>
<tbody>
<tr>
<td>Pond Construction</td>
<td>Soil Conservation Service</td>
</tr>
<tr>
<td>Pond Fertilization</td>
<td>Florida Game &amp; Fish Commission and Soil Conservation Service</td>
</tr>
<tr>
<td>Fish Stocking, New Pond</td>
<td>Soil Conservation Service</td>
</tr>
<tr>
<td>Fish Stocking, 1-10 Acre Ponds</td>
<td>Florida Game &amp; Fish Commission</td>
</tr>
<tr>
<td>Plant Management &amp; Control</td>
<td>Department of Natural Resources</td>
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</tbody>
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COUNCIL FOR AGRICULTURAL SCIENCE AND TECHNOLOGY

CAST
What It Is, What It Does, and How It Operates

Editorial Note: CAST was ten years old on
May 26th. That's the anniversary of its incor-
poration. Starting with nine scientific societies,
it has developed into a consortium of 25
societies representing most of the major food
and agricultural science disciplines. The Florida
Aquatic Plant Management Society is an asso-
ciate society member. Dr. William T. Haller is
a member of the CAST Board of Directors.

CAST: WHAT IT IS

Organization
CAST is a consortium of the following
food and agricultural science societies
(the year indicates when the society
joined CAST):
American College of Veterinary
Toxicologists (1975)
American Dairy Science Association (1975)
American Forage and Grassland Council (1972)
American Meat Science Association (1978)
American Meteorological Society (1972)
American Phytopathological Society (1976)
American Society for Horticultural Science (1972)
American Society of Agricultural Engineers (1974)
American Society of Agronomy (1972)
American Society of Animal Science (1972)
Aquatic Plant Management Society (1979)
Association of Official Seed Analysts (1973)
Council on Soil Testing and Plant Analysis (1973)
Crop Science Society of America (1972)
Institute of Food Technologists (1977)
North Central Weed Control Conference (1976)
Northeastern Weed Science Society (1978)
Plant Growth Regulator Society of America (1980)
Poultry Science Association (1972)
Rural Sociological Society (1975)
Society of Nematologists (1972)
Soil Science Society of America (1972)
Southern Weed Science Society (1975)
Weed Science Society of America (1972)
Western Society of Weed Science (1978)

Through their representatives on the
Board of Directors, the member societies
control the policies and activities of
CAST.

Purpose
To advance the understanding and use
of food and agricultural science and
technology in the public interest by serv-
ing as a resource group from which the
public and government may seek informa-
tion on the science and technology of
food and agricultural issues of current
concern, and independently to identify
developing issues of broad public con-
cern on which food and agricultural
scientists and technologists can provide
information; to organize task forces of

food and agricultural scientists and

CAST: WHAT IT DOES

Publications Related to Educational Activities

Reports are CAST's primary output.
They are statements under joint author-
ship on the subject addressed. Reports
are authorized by the Board of Directors or
the Executive Committee, usually in
response to a specific request or an-
nouncement from Congress or a federal
agency.

Reports are prepared by task forces of
eminent authorities representing the
various disciplines relevant to the sub-
ject. These persons, who are not neces-
arily members of CAST or of CAST
member societies, are nominated by
their respective scientific societies or by
the task force chairperson. Task forces
are charged with preparing a sound, fact-
tual statement on the particular subject
they address, not with taking a position
or making recommendations.

Task force members serve as scientists,
not as representatives of their em-
ployers. They receive no honoraria but
are reimbursed upon request for travel
expenses to meetings. Their time is con-
tributed by their employers.

Generally reports are of two types: (a)
an original document bringing together
the known relevant scientific facts about
a current issue and (b) a review of the
scientific content of a public document.
The reports are not original research.
Costs of preparing, publishing, and dis-
tributing the reports are borne by CAST.

Papers are speeches and other exosi-
atory statements other than official letters,
usually written by one person, that are
of such character and length as to justify
numbering them as CAST documents.

Special Publications consist of two or
more documents, each with one or more
authors, published within one cover;
nonexpository subject matter; or both.
The Directory of Environmental Scien-
tists in Agriculture is an example.

COMMENTS from CAST are official
letters and other comments of broad in-
terest, usually written by only one
person.

NEWS from CAST is a bi-monthly
bulletin that provides information on
CAST activities, including a summary of
reports and other publications.

The CAST Publications Catalog is a
continually updated listing of CAST publications.

Publications About CAST
Council for Agricultural Science and Technology is a continually revised eight-panel general information folder, including an application for individual membership.

Highlights of CAST History: 1970-1981 reviews important events in the formation and development of CAST. Updated annually.

Articles of Incorporation is the legal document establishing CAST as a non-profit corporation. May 1972.

Byllaws is the operating document that implements the Articles of Incorporation. Revised as needed within the framework established by the Articles of Incorporation. July 1981.

Policies and Guidelines summarizes the policies and guidelines established by the Board of Directors to guide CAST activities. Revised as needed. February 1982.

CAST’s Funding and Credibility reviews the issues related to the unrestricted grants that constitute CAST’s principal income and explains the mechanisms by which CAST’s scientific output is dissociated from the funding. December 1979.

Sites and Dates of Annual and Semi-annual Meetings of Member Societies of the Council for Agricultural Science and Technology and Other Related Organizations provides chronological listings for three years and alphabetic listings for five years. Forty-four scientific food and agricultural societies and related groups are listed. Revised annually.

Publications Distribution
Publications are distributed to target audiences as appropriate. The most common audiences are federal agencies, congressional committees, Congress, newspapers, and other nonagricultural audiences. Copies of all publications are distributed to all CAST members except the individual members, who may obtain copies of most publications upon request. Publications are not copyrighted. Their secondary reproduction and distribution by interested individuals or groups is invited.

Other Activities
CAST serves as a source of names, addresses, and telephone numbers of scientists knowledgeable in food- and agriculture-related subjects of interest to newspapers and members of Congress. Occasionally, arrangements are made for participation of scientists in hearings, television programs, and radio programs.

CAST has sponsored six telephone "dial-ouges" in which eminent scientists were assembled to answer questions telephoned in toll-free by consumers and students throughout the 48 states. The first was on pesticides (1973), the second on food production (1975), and the third, fourth, fifth, and sixth on food production, food safety, and nutrition (1976, 1977, 1978, and 1980).

CAST: HOW IT OPERATES

Board of Directors
The Board of Directors is the policymaking and governing body of CAST. Each member society is represented on the Board by one to three Directors, depending upon the number of members in the society. Directors are appointed by their respective societies for three-year terms. They may succeed themselves. Each member society determines its own method of selection. In addition, four members of the Board are selected by vote from the individual members of CAST. Except for the Executive Committee, all Board members are either representatives of member societies or representatives of individual members.

The Board of Directors meets semiannually, with the annual meeting held in February. Between sessions the powers of the Board are delegated to the Executive Committee. In practice, the Board decides certain important matters between meetings by mail ballot.

Executive Committee
The Executive Committee consists of the President, the President-Elect, the Past President, the Executive Vice President, and four Members-at-Large. Except for the Executive Vice President, who is appointed by the Board, all members of the Executive Committee are elected from the membership of the Board. The President-Elect serves succeeding one-year terms as President and Past President. Members-at-Large are elected for four-year terms. Members of the Executive Committee serve as individuals and are replaced on the Board by other representatives of their respective societies or by other representatives of the individual members, as the case may be.

The Executive Committee meets four times annually, once midway between and once immediately preceding each of the semiannual Board meetings.

Officers
Officers of CAST for 1982-1983 are:

President: R. Phillip Upchurch, Tucson, Arizona
Past President: O. D. Butler, College Station, Texas
President-Elect: W. F. Hueg, Jr., St. Paul, Minnesota

Headquarters Staff
Executive Vice President: Charles A. Black
Vice President: Theodore Hutchcroft
Program Development Assistant: Janice Lawlor
Accountant/Office Manager: Joyce Smith
Secretaries: Lois Bush and Nancy Sunstrom

Members and Participants
Society Members: Nonprofit, scientific societies related to food and agriculture (generally national organizations) whose principal purpose is to advance the scientific and professional interests of their members. The member scientific societies control the policies and activities of CAST. Each society pays an annual fee up to $6,000 based on its membership. Four other classes of members and participants provide additional financial support.

Associate Society Members: Nonprofit societies related to food and agriculture, including (1) state societies, (2) national societies that are not classed as scientific societies, and (3) the following regional societies: (a) regional scientific societies that are branches of national societies dealing with the same subject matter, (b) regional scientific societies that do not qualify for society membership, because they do not pay dues assessed on society members, and (c) regional societies that are not classed as scientific societies. Annual fee: $120 for national groups, $60 for regional and state groups. There are eight associate society members.

Sustaining Members: (1) For profit. Companies, cooperatives, and financial institutions. Annual fees range from $125 to $6,000. There are 124 members in this category. (2) Foundations. Annual fees range from $125 to $6,000. There are five members in this category. (3) Nonprofit membership-type organizations, generally trade and commodity associations, that are not operated for scientific purposes. Annual fee: $120 for national groups, $60 for regional and state groups. There are 253 members in this category.

Individual Members: Persons supporting the objectives of CAST and wanting to keep informed on its activities. Annual fee: $15. They elect four from their classification to serve on the Board of Directors, the only nonsociety representation. There are over 3,950 individual members.

Participants: Individuals and organizations who provide grants in amounts other than those specified for the relevant member category. Grants are either unrestricted as to purpose or are solicited for specific purposes made known to potential donors. There are nearly 100 participants.

Subscriptions
Libraries and other information centers as well as individuals may subscribe to CAST publications. A subscription for one calendar year is $35 in the United States, Canada, and Mexico, and $50 elsewhere.

Other Income
CAST sells its publications at costs determined by the Board of Directors.

Tax Status
CAST is a tax-exempt corporation. Membership fees and contributions are tax-deductible.

Budget
The budget for the 1981-1982 fiscal year (October through September) is $400,600, an amount that is expected to be covered by current income from membership fees, grants, and publication sales. Funds are used for travel and subsistence, printing, mailing, and administrative expenses.
tion rate. In some instances, such as algae control, a measurement of water volume (usually measured in acre feet) must be determined for proper application of the herbicide.

None of the herbicides are cheap, so the label should be carefully read before application.