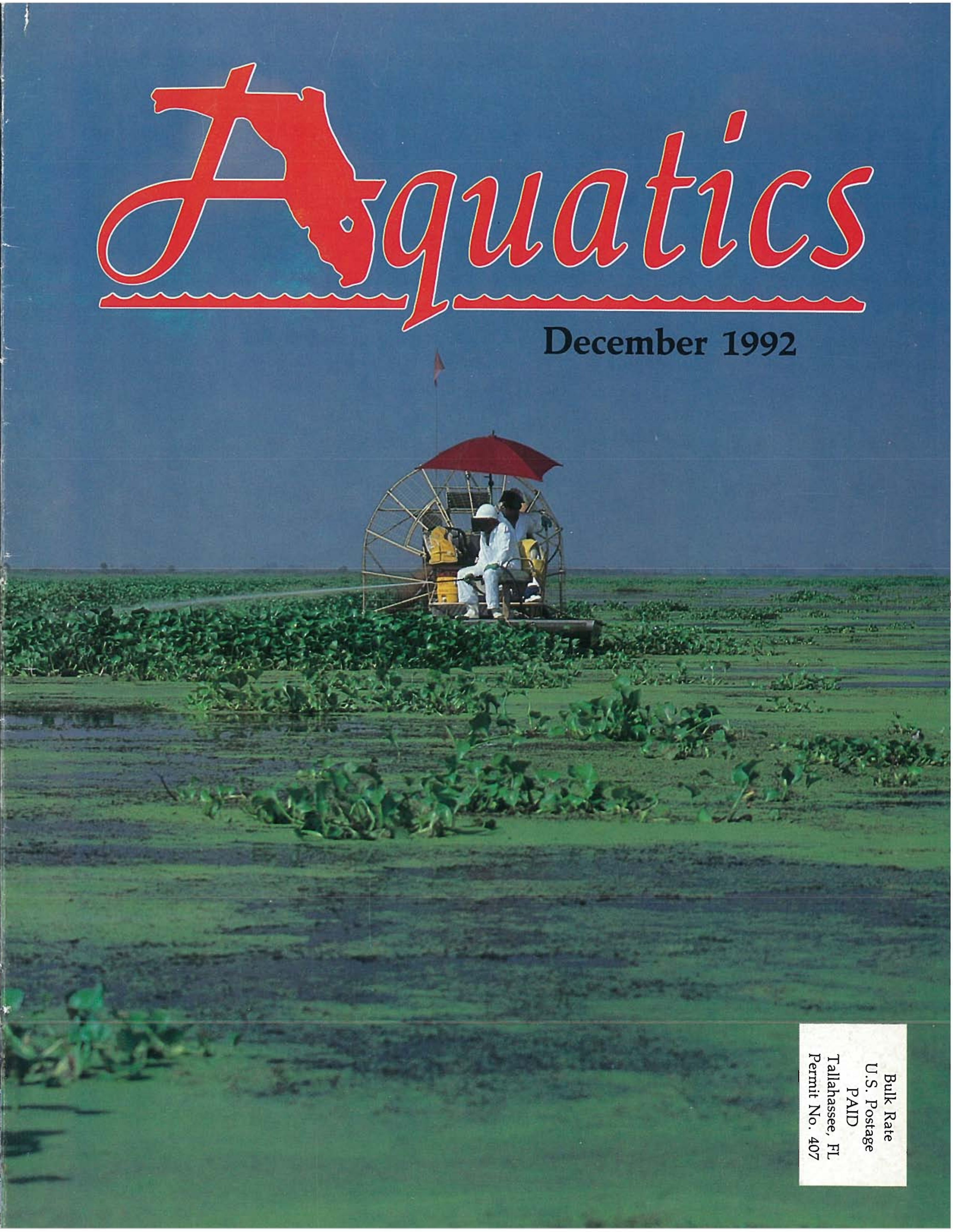
Aquatics

December 1992



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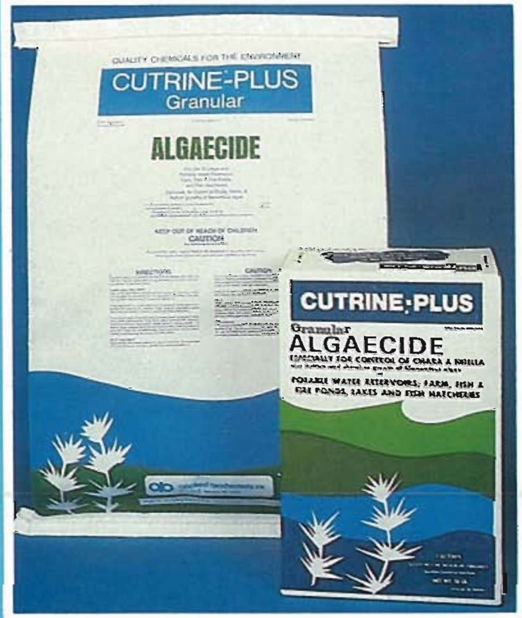

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Letter to the Editor

At the 1992 FAPMS Annual Business Meeting in Clearwater, a coup d'etat deposed Mike Bodle as Editor. The new Editor was installed by a legal election after a nomination from the floor. However, as in any coup, the methods used to secure votes for the challenger and fairness of the election were in question, especially because Mike was not able to be at the meeting to protect his reign. What is most important is that the coup was not motivated by any dissatisfaction with the incumbent but by the availability of a willing candidate to take over as Editor and a belief that Mike needed a rest from the duties of Editor so that he can be piled high with other Society responsibilities.

Mike has served us faithfully and energetically as *Aquatics* Editor since 1989. His devotion to the magazine has not only been appreciated by the FAPMS Boards, with which he has served, but also by the thousands who enjoy reading and learning from *Aquatics*. Our appreciation will be further expressed in the next issue of *Aquatics*.

As I assume the responsibility of *Aquatics* Editor I am challenged by a tradition of excellence, which has been established by Mike and Editors, Dan Thayer, David Tarver, Paul Myers, and Bill Maier before him. I am excited about my new job and accepting this challenge, but I also know that previous editors did not do the job alone. An editor is "1, one who edits; one who corrects, compiles, etc. 2, one who selects the contents for a publication." It is the entire FAPMS membership and your contributions that provide the contents for the editor and make *Aquatics* what it is. As always, I look forward to working with all of you.

Ken Langeland

About The Cover

In a holiday-colored scene, South Florida Water Management District aquatic plant technicians treat Lake Okeechobee's troublesome weeds, while visions of weed-zapping Christmas freezes dance in their heads.

Photo by Cindy Pelescak, SFWMD, West Palm Beach.

Aquatics

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CONTENTS

AQUATICS: Published quarterly as the official publication of the Florida Aquatic Plant Management Society. This publication is intended to keep all interested parties informed on matters as they relate to aquatic plant management particularly in Florida. To become a member of FAPMS and receive the Society newsletter and Aquatics magazine, send $20.00 plus your mailing address to the Treasurer.

EDITORIAL: Address all correspondence regarding editorial matter to Mike Bodle, Editor, *Aquatics* Magazine, P.O. Box 24680, West Palm Beach, FL 33416.

Composite radar image of Hurricane Andrew making landfall in South Dade County.

Photo courtesy of the National Oceanographic and Atmospheric Administration.

Hurricane Andrew: The Aftermath

Hurricane Andrew roared into South Florida near Homestead on August 24 at 0500 hours. Evacuation efforts all along the east coast helped limited the human toll. Despite that, 36 people died as a result of the storm. By mid-morning on the 25th, Andrew was charging on towards Louisiana's gulf coast, leaving horrifying destruction behind. The Homestead area may never recover physically and economically from this awesome display of the implacable and dispassionate forces of nature.

However, things could have been much worse. Andrew was a relatively dry hurricane, with an average of only 4-6 inches of rainfall, meaning flood damage was limited. The storm was also compact and fast-moving, which also mediated damage. All the same, Hurricane Andrew left a 30-mile wide path of nearly complete destruction. Few structures survived the 160-plus miles-per-hour winds. Environmental damage is still being assessed. Physical damage reached $30 billion - a record high for any natural disaster. Hopefully, the survivors will be able to regain their lives and livelihoods, and never again face another night of such terror and devastation.

Trees that were toppled along flood control canals, roadways, and onto houses, were, often as not, exotic species. In this photo, Australian pines and asian rubber treas are shown. Many native trees survived the storm, although initially leafless, most are now resprouting foliage.

At Bill Baggs Cape Florida State Park, Key Biscayne, all that remains is the 1825 lighthouse and row upon row of toppled Australian pines.

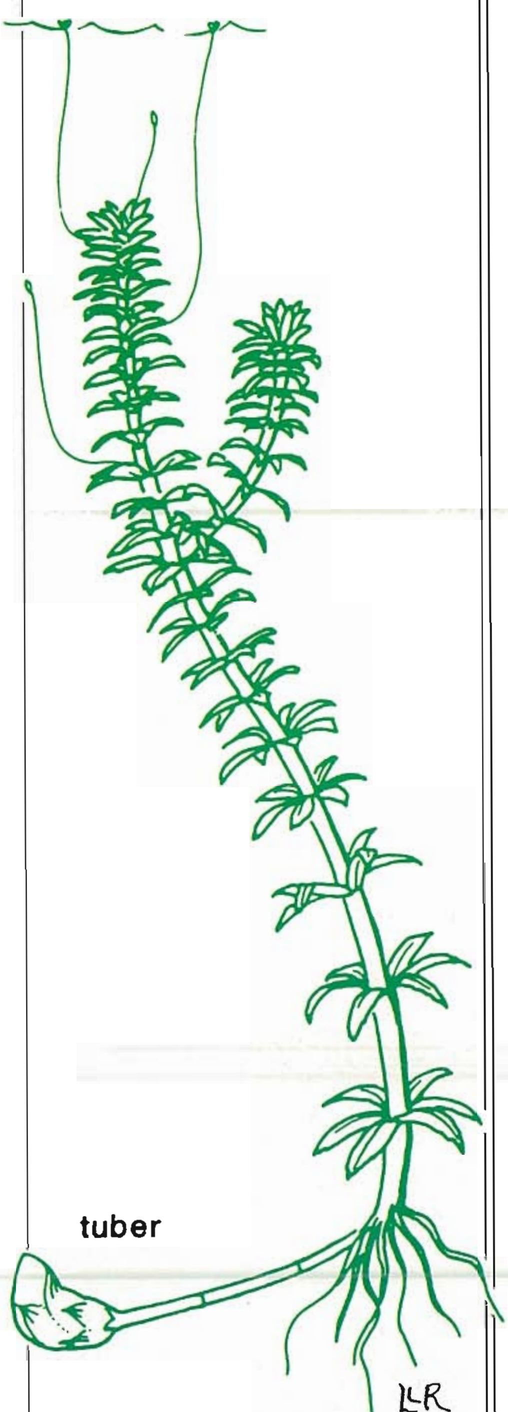
Little is left of this home where a family once felt secure against the storms of life.

Faced with almost total devastation, Homestead's future could be bleak, or hopeful and ripe for rejuvenation.

Note: All black and white photos are by Gene Li and courtesy of South Florida Water Management District, West Palm Beach.

Growth Potential of Hydrilla

by
David L. Sutton[1] and Thai K. Van[2]



Hydrilla, plant. Drawn by Laura L. Reep, University of Florida, Gainesville

Introduction

According to a recent article in "Aquatics" magazine by Jeff Schardt (1992), hydrilla (*Hydrilla verticillata* (L.f.) Royle) is alive and well in Florida in spite of tremendous amounts of money and effort being spent to control this exotic aquatic plant. Jeff's article indicates that 1991 was a good year for hydrilla with an increase of nearly 10,000 acres over that reported for 1990. Hydrilla is now estimated to cover more than 66,200 acres, "the highest ever recorded in Florida public lakes and rivers."

This information comes as no surprise to those in the field who are working to control hydrilla. Hydrilla is a very aggressive plant, and will probably remain a major nuisance problem in Florida and elsewhere for a number of years to come. Hydrilla possesses several characteristics that make this submersed plant difficult to control. A brief review of some of these characteristics may provide some insight into hydrilla's ability to gain and maintain dominance in a body of water.

Native Habitat

Hydrilla's native home is Asia (Cook 1985), but through either purposeful or accidental introductions, it has naturalized in a number of other geographical areas. Hydrilla probably causes more world-wide problems than any other submersed plant.

Distinguishing Characteristics

The genus *Hydrilla* contains only one species, *Hydrilla verticillata,* but a number of biotypes or races occur throughout temperate and tropical regions. The genus *Hydrilla* derives its name from Greek 'hudor' for water.

Hydrilla belongs to the Frog's bit or Hydrocharitaceae family which contains desirable plants like eelgrass *(Vallisneria)*, the marine aquatic grass *(Thalassia),* and frog's bit *(Limnobium)*. All plants in this family share a comon trait termed 'epigyny', a type of flower arrangement where the petals, sepals, and stamens grow upon the top or appear to grow on top of the ovary.

Leaves of hydrilla are in whorls of three to six around stem nodes. In fact, 'verticillate', means a type of arrangement where leaves, flowers, branches, etc. surround a stem in a circle upon the same plane. Leaves have sharply toothed margins and spines on the underside of the midrib. The latter is an excellent characteristic to help distinguish hydrilla from similar submersed plants like Egeria *(Egeria densa)* an Elodea (*Elodea* spp.). In fact, when hydrilla was first found in Florida, it was called "Florida Elodea" because of its similarity to the North American *Elodea canadensis*.

Hydrilla plants are dioecious or monoecious. Dioecious plants have either male or female flowers on the same plant, but not both. In Florida, only dioecious hydrilla plants with female flowers are known to occur. Monoecious plants contain both femaile and male flowers on the same plant. Monoecious hydrilla is known to occur in North Carolina, the

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Potomac River, and a few other areas in the northeastern part of the country. Naturalization of monoecious hydrilla plants in Florida has not been reported, and diligence is needed to prevent this biotype from becoming established in the state.

Morphological Characteristics

Hydrilla is a submersed plant growing with its roots in the sediment and shoots in the water column. Rhizomes either grow horizontally near the sediment surgace and send up new shoots from nodes or grow down into the sediment and produce vegetative propagules at their tips. Hydrilla cannot survive out of the water, but at times, dense populations will have their stems and leaves pushed above the surface of the water by stems growing up from below. Hydrilla shoots have long, branching stems with many nodes. Each node is capable of producing a new plant although stem fragments with multiple nodes have a much higher chance of new plant formation than single-node fragments (Langeland and Sutton 1980).

Dioecious hydrilla stems have long internodes with few branches in deep water but as the stem approaches the surface of the water the internodes shorten and profuse branching occurs resulting in a 'mat' of hydrilla. Often the mat is of such a thickness and density to shade competing neighboring submersed plants and results in the typical monoculture of hydrilla plants that dominate a body of water.

Under experimental conditions in South Florida, monoecious hydrilla produces a much denser biomass just above the sediment that the dioecious form. This type of growth habit needs to be considered during plant surveys. By the time monoecious hydrilla is seen on the water surface, usualy a considerable amount of plant material is already covering the bottom sediment.

Reproduction

Reproduction of dioecious hydrilla in Florida is by vegetative means only. New plants develop from stem nodes, rhizomes, root crowns, axillary turions, and subterranean turions (usually called 'tubers'). Technically, hydrilla does not produce tubers. Hydrilla actually produces only one vegetative structure, turions, that allows it to survive adverse conditions such as drying or a herbicide treatment. A turion is defined as a young scaly shoot with a single apical meristem budded off from stems. Axillary turions, which are produced in the axils of leaves in hydrilla shoots, are surrounded by scaly, green leaves, and are rather small. Little is known of the production of axillary turions and their importance in regrowth of hydrilla once the parent plants have been controlled. It is not uncommon to see turions produced by detached stems under stress such as stem fragments floating on the surface of the water during cool weather

Figure 1. Size comparison of dioecious (top) and monecious (bottom) hydrilla tubers. (Photo by Thai Van)

Subterranean turions, or tubers, are produced in the sediment at the end of rhizomes. At first glance, tubers do not show the distinct scaly appearance of axillary turions. The surface of a tuber is generally rather smooth. Tubers normally are somewhat banana-shaped but enlarged in the middle with a pointed end containing the apical meristem and the opposite end with a scar where it was attached to the rhizome. A microscopic examination of the tubers will reveal its scaly surface. Tubers exposed to light while still attached to the rhizome will turn green, but normally they are white. Tubers also can be black, orange, gray, and various shades of these colors.

Tubors of dioecious hydrilla are produced in response to photoperiod, whereas monoecious hydrilla plants were found to produce tubers year-round in outdoor tank studies in Florida (Sutton et al 1992). Dioecious hydrilla produced up to 3,500 tubers per meter square (equivalent to over 14 million per acre) within 4 months of planting a single sprouted tuber while monoecious hydrilla produced almost twice that number. However, tubers produced by monoecious plants were about one-third less in size that the dioecious ones (Figure 1), and perhaps may have a shorter life than dioecious tubers due to their smaller amount of food reserves. Tubers produced by monoecious hydrilla plants have been found to germinate up to 4 years after detachment from the rhizome (Van and Steward 1990).

In Florida, monoecious hydrilla produces tubers within 4 to 6 weeks after planting. Dioecious hydrilla on the other hand grows 8 to 12 weeks before initiating tuber production. Since under experimental conditions monoecious hydrilla has been found to produce tubers year-round, at least in South Florida, this eliminates the window of opportunity for preventing tuber formation as may be possible for dioecious hydrilla.

Furthermore, monoecious hydrilla is capable of producing viable seeds. The seeds have been observed to germinate and produce young seedlings in the laboratory. Although seed production is low and does not appear to contribute significantly to the reproduction and spread in naturalized populations such as those found in North Carolina, it may offer these plants the possibility of genetic recombinations and production of more adaptable new varieties.

Biomass Production

Hydrilla does not produce a great deal of plant material as compared to other submersed plants. Haller and Sutton (1975) measured biomass of 0.8 tons dry matter per acre for hydrilla and 3.1 tons per acre, dry matter, for eel-grass (*Vallisneria americana* Michx.) in ponds in Central Florida. In outdoor tanks in South Florida (Sutton et al 1992), biomass of dioecious hydrilla grown for 16 weeks during the summer was equivalent to 1.9 tons dry matter per acre. In general, submersed freshwater plant communities are much less productive than floating and emergent communities (Gerrard and Van,

1982). For example, waterhyacinth (*Eichhornia crassipes* (Mart.) Solms) under ideal growing conditions (Reddy and Sutton 1984) may produce 25 tons of dry matter per acre during the summer growing season.

The major problem with hydrilla is that it produces a tangled mat of stems and branches within the top 3 feet of a body of water that interferes with many uses of the water in which it is growing.

Hydrilla is found in may different aquatic habitats, which suggest that its growth requirements are not very specific. Water temperature, sediment and water nutrients, and biotypes will influence the amount of biomass produced.

Sediment nutrients such as nitrogen, phosphorus, iron, and perhaps a few others are taken up by the roots of hydrilla. Other nutrients are taken up by the shoots. Florida waters have an abundance of naturally high levels of phosphorus that generally provides hydrilla with adequate amounts of this nutrient. Nutrients such as nitrogen and iron may be present in a limited amount in a body of water and would influence the growth of hydrilla.

In a study (Sutton 1986) using sand and fertilizer, the amount of hydrilla biomass produced was dependent on the amount of fertilizer and the time of year. Plants grown in sand grew very little, but the addition of small amounts of fertilizer increased growth 6 to 14 times that of plants cultured in sand alone. Hydrilla growth in South Florida was found to be higher in the summer than in the winter but considerable variation in winter biomass occurred due to water temperature differences from year to year. These results suggest that nutrient analyses of sediments may give an indication of the potential growth of hydrilla that might occur in a particular body of water.

One of the unique features of hydrilla is its ability to begin photosynthesis under extremely low light levels such as that in deep water or in the early morning hours. These levels are lower than that required for Florida's native submersed plants. In the mornings, by the time light levels are sufficient for photosynthesis to begin by native plants, hydrilla has already been actively removing carbon dioxide from the water resulting in a reduction in the amount available for growth by native plants.

Uses of Hydrilla

Hydrilla is not all bad. For example, diving ducks and coots consume vegetative parts of hydrilla, and it is considered an extremely important food plant by some wildlife personnel for use in some waterfowl management programs. Hydrilla plants also provide cover for small fish and other aquatic organisms. Hydrilla plants add oxygen to the water, but dense mats remove oxygen from the water at night.

A few hydrilla plants are beneficial to a body of water. The problem with hydrilla is that is is so aggressive and competitive that it usually dominates a body of water at the expense of desirable native plants. Hydrilla must be managed if a body of water is to be used to its fullest potential.

Management of Hydrilla

Two useful methods for management hydrilla are herbicides and grass carp. Several herbicides are quite effective for controlling hydrilla. Water flow is a major problem encountered with herbicides since the herbicide may not come in contact with the plants for a sufficient time to cause damage to the plant. Another major problem is the size of area to treat with herbicides which really translates to money, or the lack of money to purchase sufficient amount of herbicides as Jeff points out so succinctly in his article.

Timing of herbicides is a critical factor in developing a herbicide program for dioecious hydrilla. Hydrilla tubers are produced under photoperiods when daylength is shorter than night time. In South Florida, the period of time when dioecious hydrilla will not produce tubers, regardless of the amount of biomass, is slightly less than 4 months, late March to early July. Consequently all hydrilla plants must be eliminated prior to early July. After July, the area must be checked monthly and sprayed as necessary to prevent any plants from forming. During the period of tuber formation, a hydrilla tuber can sprout, grow, and produce new tubers within 8 weeks. To eliminate tuber production in South Florida, no hydrilla plants can be present for 8 weeks or longer from mid-July to mid-March of the next year.

More recently, new herbicides such as bensulfuron methyl are reported (Anderson 1988) to have the ability to regulate and suppress hydrilla tuber production. Herbicides such as this may offer much needed management solutions for long-term control of hydrilla regrowth from weed populations. Unfortunately, it appears that the manufacturer will not pursue a label for use of bensulfuron methyl in aquatic systems.

Large grass carp, 5 to 10 pounds in weight, are extremely useful to prevent regrowth of hydrilla from sprouted tubers or stem fragments once herbicides have been used to remove the dense population of hydrilla. Since grass carp like to feed near the surface, they will effectively remove any new hydrilla plant that tries to grow to the surface.

In Florida, using herbicides to remove the initial amount of hydrilla, followed by stocking only a few large grass carp, 1 to 3 per acre, avoids problems that might exist due to stocking high numbers of small fish. The feeding activity of large grass carp is reduced somewhat as compared to small fish, and large fish tend to feed more selectively on young, tender plants such as new hydrilla shoots trying to reach the surface.

Management of Florida's hydrilla problem is difficult and costly, and will remain that way for some time to come. Because of hydrilla's tremendous growth potential, leaving just one tuber or a single stem fragment in a body of water often may negate an effective control program. In any management program, monitoring is essential to identify and prevent any new plkants from forming once the main problem has been eliminated. Managers who recognize the various ways in which hydrilla can become established and grow will be able to implement effective management strategies to reduce nuisance growth of hydrilla.

Acknowledgements

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Additional reading

IFAS Circular 884, "Hydrilla - a continuing problem in Florida waters" may be obtained, free of charge, from the University of Florida, IFAS, Center for Aquatic Plants (904/392-9613) or the Fort Lauderdale REC (305/475-8990). Quantities can be obtained for distribution at meetings or other public functions.

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"IT'S A WRAP!" or How I Learned To Make Great Video Out In The Weeds

Phil Chiocchio and Karen Brown get down to some serious video editing.

by Karen Brown, Senior Information Specialist, University of Florida IFAS Center for Aquatic Plants

"Sure, sounds like a great idea," I responded when confronted with the idea of producing an aquatic plant identification video series. I think the original number of plants to be covered was about twenty five. Two years, gallons of sweat in the field, and months on end in the editing room later, we wrapped up the project with the seventh tape and 115th plant. It was the Sistine Chapel of aquatic plant identification on video. As happens so often with seemingly simple jobs, I had no idea . . .

Who Wants to Write the Script?

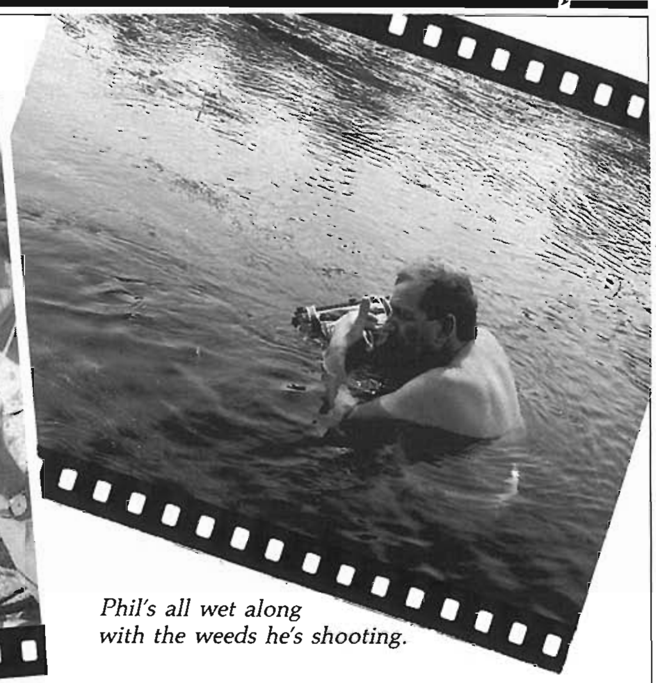
An integral part of the video process is writing the script. Although this seems obvious, no one ever seems to consider it. Everyone has great ideas about topics but no one wants to write the script. Why? Because it's hard! It needs to be specific, it needs to be correct, it needs to be written with visual imagery in mind, it needs to be agreed upon by the various "project cooperators." Vic Ramey wrote the script for each of 115 plants by closeting himself away with his computer, about ten aquatic plant taxonomy books and a telephone for occasional calls to botanist David Hall or the herbarium on the University of Florida campus. It was, to put it mildly, a BIG job. Different books give different descriptions, botanists have their own ideas and people in the field have theirs. Once all of this information was synthesized into a so-called "final" script (the joke was on us), Phil Chiocchio, our intrepid video man, and I, the somewhat less intrepid field producer, found that the actual living plants often didn't cooperate with the script! The books may say that lemon bacopa has five-petaled blue flowers, but we found acres of them with only four-petaled blue flowers. Back to the drawing board.

Vic kept writing up scripts for the identification of each plant and the plant list kept getting longer and longer. I began to notice that people become partial to certain plants. Vic couldn't let go of the beak-rushes (*Rhynchospora*) and became highly agitated when it was suggested that we drop elderberry (*Sambucus*) and water hemlock (Cicuta). DNR biologist Joe Hinkle was partial to redroot (*Lachnanthes*) and I insisted on star-rush (*Dichromena*). I expected a lot of argument over common names because they are exactly that, common to an area or a group of people or a single person. But even Latin names change, so back to the books Victor would go. Vic even "discovered" that there are two species of *Hygrophila* in Florida when it was commonly accepted that there was only one. To find the native lake hygrophila, we called the herbarium to ask for a location from their newest specimen, which turned out to be from 1968. I refused to believe we would find any at the named spot but we dutifully climbed into the truck and headed over to a bridge on Highway 301 between Waldo and Starke. To my amazement, there were about three plants valiantly growing among a sea of weeds and we got our shots.

Field Work

Throughout the process of videotaping the plants, we learned that there are certain rules that go with the job. Here are a few of them: 1) People who, in all honesty, tell you that they have tons of a certain plant in their area, will suddenly find the plants to be all gone when we show up to videotape them. Whether it's from a herbicide treatment, cold weather, rising water levels or just a mystery disappearance, we have more than once heard, "Well, there used to be and acre of it right here!" 2) As soon as we try to shoot extreme close-ups where stillness is critical, gale force winds arrive. 3) As soon as we set up our equipment to shoot ditchbank plants, convoys of tractor-trailer rigs show up to blow us off the side of the road. 4) Fire ants seem drawn to the legs of the tripod, which is usually where Phil stands. 5) We can always locate a species right after it finishes blooming for the season. 6) Once we finally find a species, usually in a terribly inconvenient and inaccessible location, wade in, shoot it, produce the segment and finish the tape in that series, we find acres and acres and acres of beautiful, blooming, easily accessible plants of that same species everywhere we look. 7) They don't make sunscreen in high enough numbers for Florida sun. 8) Airboat drivers seldom carry anchors and 8b) it is impossible to keep an airboat still in the water without one and 8c) Phil Chiocchio has some pretty interesting scientific lingo of his own, and 8d) we have a lot of videotape footage that would make a sailor seasick. 9) Giant cutgrass cuts (see (my) blood on Grasses, Sedges and Rushes, Part I, Segment 20.) 10) A video camera in an underwater housing strongly wants to float, and Phil has added "can swim underwater with a cement block" to his list of job skills.

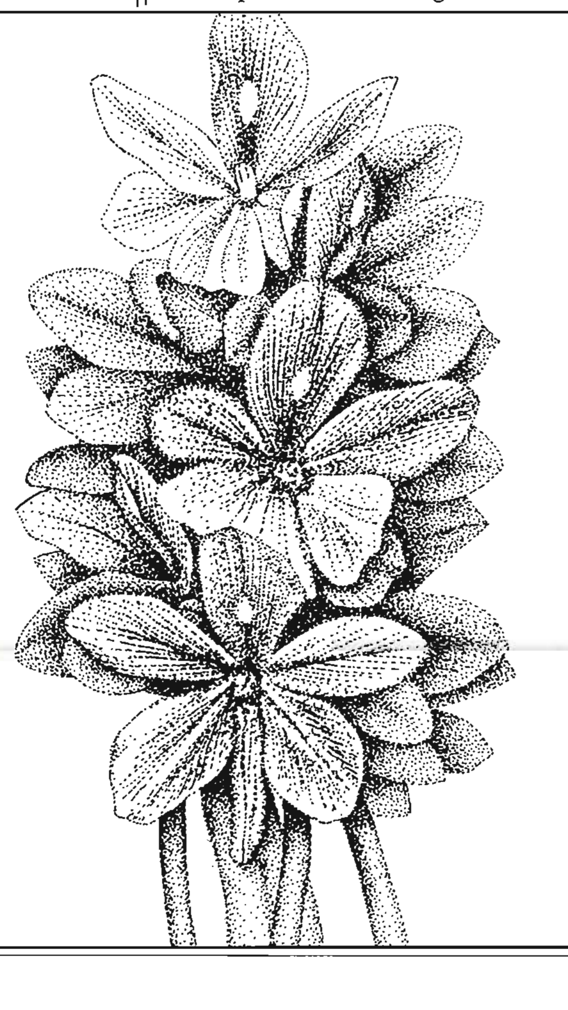
Karen models the latest in grasses for Phil's camera.



Phil's all wet along with the weeds he's shooting.

Putting it all Together

Once the video footage is taken, the seemingly endless job of editing and post-production begins. Ken Langeland did an excellent job of narrating the script, with occasional interruptions to challenge Victor on



botanical details or to call the herbarium to settle arguments on how to pronounce *Cladium jamaicense*, for example. We usually managed to have a good time and Ken finally became quite expert at recognizing which beep meant he had ten seconds and which beep meant to start narrating NOW. After getting the script recorded, hearing Ken's voice for eight hours a day, week after week, forward, backward, fast, slow and normal was, well, special.

For all the sun we got while videotaping material in the field, we felt like cave-dwellers after editing sessions in a tiny, darkened room that lasted for months. On a very good day, we could produce perhaps five minutes of finished video, including narration, renarration, edited video, computer animations, graphics, music, and sound effects. By the time we finished the seventh tape in the series, we had produced 274 minutes or 4 1/2 hours of finished video.When we started the last part of the series, the Grasses, Sedges and Rushes, we had already completed 75 plant segments on five tapes. When we put number 1 up on the screen for the first of the grasses, and I knew we had 40 more to go, I was of the mind that all grasses, sedges and rushes looked alike and should simply be mowed.

But we did it - seven tapes covering 115 floating plants, emersed plants, submersed plants, and grasses, sedges and rushes. We've gotten accolades from all over and we're as pleased as new parents. The tapes are being used all over this country and in several countries overseas. To date, about 400 individuals, agencies, universities and others have purchased the earliest tapes (Floating Plants and Emersed Plants I and II), and sales of the later released tapes (Submersed Plants I and II and Grasses, Sedges and Rushes I and II) are catching up. And now we are getting requests for customized tapes covering specific plants in other areas of the country.

A few, final comments on some of the other things we learned during the course of this project: 1) field people, whether they work for DNR, a WMD, GFC or ACOE, were helpful and patient with all of our equipment and the long hours required trying to be still in the sun and wind, without exception, every time we asked, 2) no matter how many times the "project cooperators" have reviewed a script, they will still come up with all sorts of new ideas during the "final" review, and 3) aquatic plants grow in some of the most beautiful spots in Florida. The project took us to places that this Florida native had never been to before. We swam with and videotaped a manatee grazing on Sagittaria (thank you, Jess Van Dyke), snorkeled in pristine springs to shoot submersed plants, spotted an otter while taping floating plants (see the Pistia segment), shot Melaleuca trees from a chopper over the Everglades, drove lots of miles, met lots of nice people and took lots of great boat rides. But now that the last tape is packaged and on the shelf, it's great to be able to say, "It's a wrap!" (The aquatic plant identification videos are available for $15.00 each, plus tax for Florida residents, from IFAS Publications, Building 664, University of Florida, Gainesville, FL 32611-0001. For a list of the plants covered, or to borrow videotapes, contact the Center for Aquatic Plants, 904/392-1799.)

Drainage Program Improved by Herbicide Applications

by Stacey Densihg
Sargent & Potratz, Inc.
Brookfield, Wisconsin

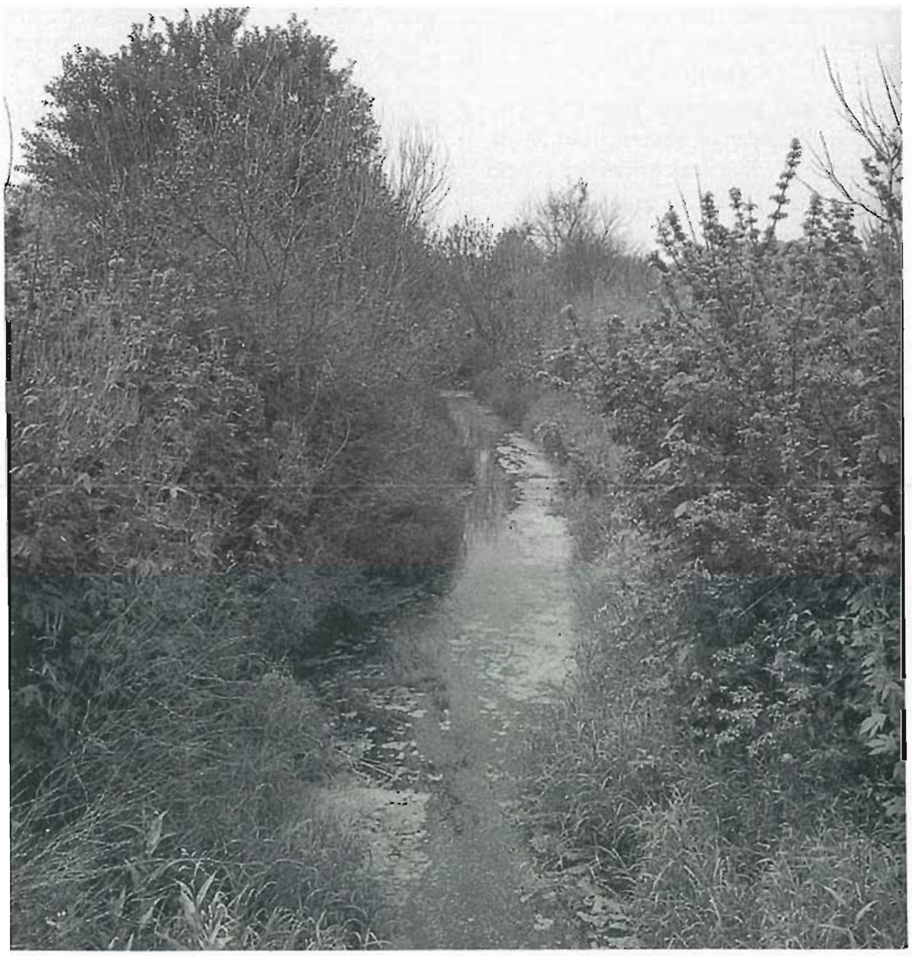
Over the past 25 years, Montgomery County, Indiana, has watched its system of drainage ways grow at an astounding rate.

Located just 30 miles northwest of Indianapolis, Montgomery County is not unlike other once-rural counties that have been overcome by suburban sprawl. As more people move in, increased construction and congestion put a strain on the existing infrastructure.

Providing adequate drainage under these circumstances can be a challenge. In the past four years alone, the number of ditches and legal drains in Montgomery County have increased by more than one-third. At present, the county has 380 miles of drainage ditches and 200 active legal drains.

As a result of this high rate of growth, it has been necessary to intensify vegetation control measures to ensure steady and reliable drainage throughout Montgomery County.

Rapid weed growth makes mechanical control difficult, according to County Surveyor Harvey Keller. Intricate root systems of undesirable vegetation block ditches, deteriorate ditch banks, increase siltation and flooding.



Over time, Montgomery County, Indiana, realized mechanical removal of problem vegetation was a losing battle. As a result, the county looked to herbicidal vegetation management to provide a less costly, more long-term alternative.

Reconstruction requires several steps

Problem vegetation causes ditches to either become completely inactive or require reconstruction. Reconstructing ditches involves removal and disposal of all vegetation from the ditch and surrounding edges. Ditches must be dredged out and side slopes reconstructed at a 2:1 slope. Two represents the distance from the edge of the water outward and one is the distance from the bottom to the top of the bank. These reconstruction tactics are followed by reseeding and fertilizing, tiling outlet pipes and riprapping where needed.

Routine maintenance the department provides is paid for by landowners through annual assessments. This amount is based on a set dollar figure per acre of active legal drains running through private property.

Keller, and his staff of three, are responsible for monitoring the condition of all legally petitioned drains. Aerial photography conducted every five years helps these county workers pinpoint vegetation problems.

"In 1987, we started a program to evaluate the effectiveness of existing vegetation management tactics," Keller recalls. "The aerial photography confirmed what we already suspected — that mechanical removal of problem vegetation was a losing battle."

As a result, Montgomery County looked to chemical vegetation management to provide a less costly, more long-term alternative. "The objective was to institute a herbicidal maintenance program that would effectively control vegetation while not harming neighboring corn and soybean crops or threatening wildlife," the county surveyor explains.

Herbicides save time and money

Keller and his crew chose to employ the services of Chemi-Trol Chemical Company of Gibsonburg, Ohio, an independent vegetation control and pavement marking contractor. "They had the right type of equipment, chemical knowledge and licensing to do an accurate and effective job without costing more," he emphasizes.

According to Keller, Chemi-Trol applied herbicide to 24 ditches in only two and one-half weeks in 1991. To control vegetation mechanically over this same area would have taken a year or more, Keller stresses. "Of course, Mother Nature was good to us and this sped up the herbicide work," he admits.

Rapid weed growth makes mechanical control difficult, according to Montgomery County surveyor Harvey Keller. Spraying herbicides in conjunction with mechanical measures provides the most cost-effective, long-term results possible.

In addition, the county experienced substantial cost savings by implementing a herbicide spray program. To maintain one acre mechanically costs approximately $600 to $900 — versus $200 for a herbicide application.

"We recommend spraying herbicides in conjunction with mechanical measures, however, in order to get the best program and experience the most success," says David Leaders, Chemi-Trol sales representative who works closely with Montgomery County. "The two tactics, if used correctly, complement each other to create the best results."

The biggest challenge, according to Leaders, is brush control along drainage ditches. Some of the brush species they target include oak, ash, elm and willow.

The county's herbicide program involves spraying approximately 20 to 40 feet of the 75-foot right-of-way on each side of the ditchbanks. Brush applications are made in late summer or early fall.

Herbicide program

Chemi-Trol selected RODEO[1] her-

[1]RODEO® is a registered trademark of the Agricultural Group of Monsanto Company.

bicide for its broad spectrum activity on brush, grass and weed species found in drainage areas. It was also a good candidate for use where impact on wildlife is a concern, says Leaders.

The crew mixes one gallon of RODEO with two quarts of Ortho's X-77 surfactant in 100 gallons of water. It is important to use a surfactant to help the herbicide penetrate and adhere to targeted foliage. By using a drift control additive, the chance of drift is reduced, he adds.

To apply herbicides, Chemi-Trol uses a FMC handgun sprayer connected to a 500-gallon stainless steel tank mounted on a four-wheel-drive skidder. "The handgun has adequate hose so crew members can spray on both sides of the ditch where necessary," Leaders explains.

If broadleaf weed and small brush control was required, Chemi-Trol would make an early spring herbicide application. Away from water, says Leaders, Chemi-Trol would spray a tank mix of two quarts GARLON 3A[1] and two quarts of 2,4-D in 100 gallons of water.

While vegetation provides a protective cover for wildlife habitats, problems still occur. "Beavers, in particular, are making a big come back in this part of Indiana," Keller explains. "They dig deep into the bank for their lodges and use the brush to build their dams. As a result, water backs up into the tiles — forcing a blow hole that pops up."

If brush is eliminated, however, beavers do not have any material to build their dams. This also results in a lack of food that eventually forces the beavers to move elsewhere.

"We have found fall foliar applications allows us to spray without damaging adjacent crops," Leaders says. "Applications are made in September or early October resulting in 80 to 90 percent brush control."

Sap is running back into the root system at this time, which causes the herbicide to be absorbed more efficiently, he says. Browning of the treated foliage blends in with actual color changes over the fall and winter.

"We also work closely with farmers who have land bordering our drainage ditches," Keller says proudly. "We send them written notices three weeks prior to spraying, informing them about the herbicide sprayed and species targeted."

This advance notice gives farmers ample time to harvest crops up to 20 feet away from the ditch banks, if they have not already done so, creating a maintenance lane for crew members.

"We also offer material safety data sheets to the county and farmers as a source of information and education on the safe handling of herbicides," Leaders adds. "Our herbicide application programs are flexible to meet the needs of our customers."

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[1]GARLON 3A is a registered trademark of DowElanco.

Pumpin' With Peristaltics

- A Herbicide Delivery System Using The Peristaltic Pump

by
Larry H. Hartmann and Rhandy J. Helton
Biologists, Texas Parks & Wildlife Department
Jasper, Texas

The waterhyacinth *(Eichhornia crassipes)* presents Texas aquatic resource managers with the need to develop safe and efficient herbicide delivery systems for the control of this exotic species. Infestations have been experienced in the state since the mid-1950s, primarily in the East and South Texas areas.

Early waterhyacinth control operations used small roller-type pumps to spray a herbicide/water mixture from a tank mounted inside the boat. However, upon emptying each tankful of mixture, the operators were forced to stop spraying, pour a measured amount of herbicide concentrate into the tank, and then either pump or dip water from overboard until the tank was once again filled. After proper agitation to mix herbicide and water, spraying was again resumed. Thus, a large portion of the total field time was not spent spraying waterhyacinths. Also, the weight factor involved in carrying a filled 100-gallon mix tank proved to be prohibitive, especially in shallow waters. A better means of fighting the waterhyacinth had to be found.

Later the "venturi" -type pump system was used to automatically meter in herbicide at a predetermined rate. Combined with overboard water intake, this system eliminated the entire refilling/mixing routine and greatly improved efficiency. But this system was not without its own problems. Metering disks used in this system were susceptible to becoming obstructed and either partially or entirely disrupting herbicide flow. Differences in the viscosity between various herbicides necessitated compensating for the reduced herbicide flow by changing metering disks. And fluctuations in pump flow rates affected the amount of herbicide metered.

Since 1987 the Texas Parks and Wildlife Department has been successfully using a delivery system which employs a peristaltic metering pump that (1) allows a high level of efficiency, (2) is relatively maintenance free, (3) requires only limited handling of herbicide concentrate, and (4) provides reliable control over herbicide rates. Description of such a system should prove useful to those personnel directly concerned with problematic floating/emergent aquatic plant species.

System Description

The basic spray unit (Figure 1) consists of a Hypro D-50 10gpm diaphragm pump coupled to an 8hp Honda electric start aircooled engine by a gear reduction assembly. Intake water is supplied through twin through-hull screened aluminum boxes welded into the inside of the boat hull. Herbicide concentrate is obtained from a supply container through the use of a Randolph-Austin Model Econ II peristaltic pumphead mounted on a 170 rpm 12-volt DC electric motor. Both pumphead and motor are enclosed in a welded, all-aluminum box for protection from the elements. A thermoplastic Cilran rubber tubing (3/16"ID x 3/8" OD), connected to the supply container, is threaded through the peristaltic pump and on to the injection site on the suction side of the diaphram pump. During peristaltic operation, the resilient tubing is alternatingly compressed and relaxed, creating a uniform flow of concentrate toward the injection site. The combination of this size tubing, peristaltic motor rpm, and their use in conjunction with a

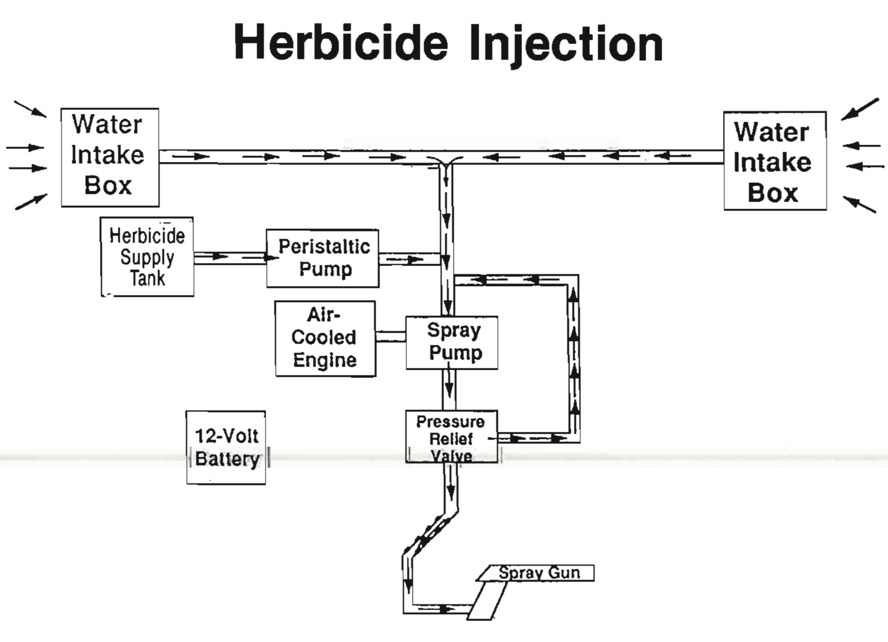

Figure 1

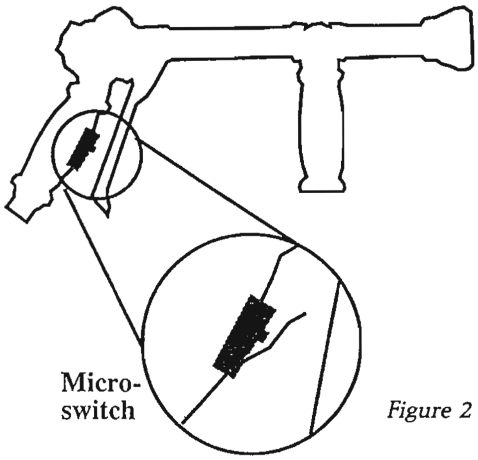

Figure 2

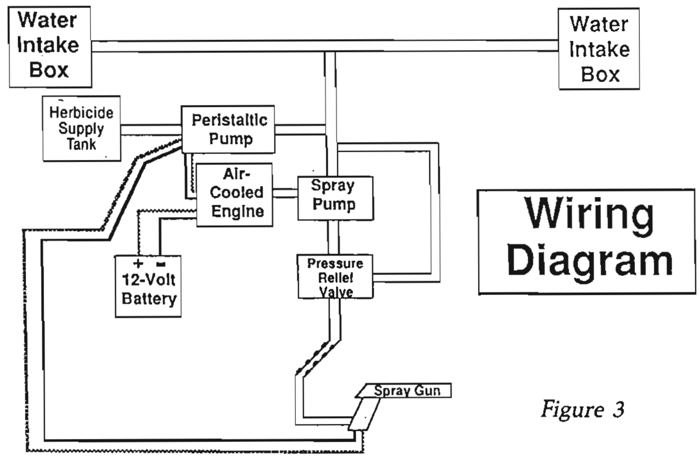

Figure 3

10 gpm spray pump, will maintain calibration at a 1% mixture commonly used in waterhyacinth control operations, regardless of product viscosity. Other combinations of these three variables may be employed to achieve spray concentrations other than 1% if desired.

Herbicide injection by the peristaltic pump is coordinated with actual spray pump output through the use of a lever-type microswitch (Radio Shack Cat. #275-016) fitted to the inside of the Hypro-Model 3381-0010 spray gun trigger mechanism (Figure 2). Depression and release of the trigger electronically activates and shuts off the peristaltic pump. Thus, peristaltic pump operation (and herbicide flow) are regulated in exact timing with spray pump demands.

Wiring for the peristaltic metering device and trigger assembly follows the schematic shown in Figure 3. Insulated 14-gauge copper wire is used for all leads. Battery charge for the system is maintained by the aircooled engine alternator. The peristaltic pump motor drains only 2 amps of 12-volt DC power during actual operation.

Maintenance/Upkeep Suggestions

After five full seasons of field usage, this agency has experienced relatively few problems associated with the peristaltic metering system. Some points of preventative maintenance are suggested, however, for proper system function and longevity.

Operators should make sure that

the battery remains fully charged. Output less than 12 volts will not allow the peristaltic motor to perform up to its rpm rating, thereby injecting herbicide concentrate at a lower rate than desired. Although the alternator will replace drain by the peristaltic motor, it may not recharge a battery that is weak prior to commencement of the day's spray activity. It is suggested that a battery charger be used occasionally, or after longer periods of inactivity, to insure proper voltage levels.

Lubricate the Cilran tubing along the roller contact area inside the pumphead immediately prior to the day's spraying. This is recommended to reduce excessive friction and wear of pumphead and tubing, and allow rated pump speed to be achieved. Any good silicon-based spray lubricant will suffice.

The Cilran tubing should be removed from the pumphead at the end of each day. This is done to prevent the tubing from acquiring a "memory" of the pump roller compression areas and, correspondingly, lose the resiliency required to pump fluid. The tubing is easily replaced and lubricated prior to the next usage.

Tubing should be adjusted through the pump housing daily to extend tubing life. Although this is not necessarily for proper operation, it does reduce the need for periodic tubing replacement.

Pumphead rollers and yoke assembly should be checked for wear at the end of each season. Extensive use will gradually result in sufficient "play" between roller and the inside of the pumphead housing to create an incomplete compression of the Cilran tubing. This results in either difficulty in the pump priming itself at the outset of the spray activity, or in partial leakage if the herbicide being pumped. Worn rollers may be replaced in minutes and are relatively inexpensive.

Summary

The peristaltic injection system has advantages over many systems presently in use by aquatic vegetation managers. It offers an alternative method by which applicators can reliably achieve pre-determined herbicide mix results with minimal effort. It affords increased safety through reduced applicator exposure to herbicide concentrate. Finally, the peristaltic system is easily calibrated and is virtually maintenance free.

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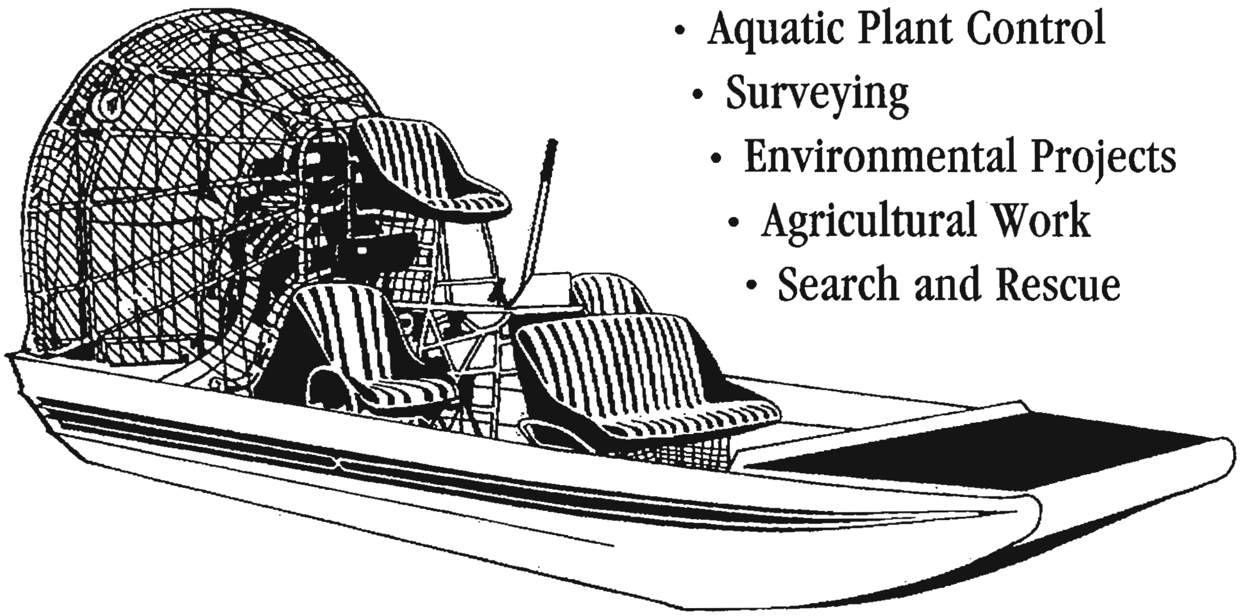

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AquaVine

The 16th Florida Aquatic Plant Management Society annual meeting was held October 27-30 in Clearwater Beach. The following awards were presented:

Aquatic Plant Manager of the Year-
 Willie Cope, South Florida Water Management District, Okeechobee Field Station.
Best Applicator Paper-
 Joe Certain, South Broward Water Control District.
Best Vendor Booth-
 Chemical Containers, Inc.
Photo Contest-
 Aquatic Scenes
  1st Place - Thomas Pinder
  2nd Place - Karen Brown
  3rd Place - Greg McClain
 Operations
  1st Place - Tom Medell
  2nd Place - Pierre Deschenes
  3rd Place - Kathleen Walters
President's Award-
 Bill Haller
Presidential Award-
 Ken Langeland
Bill Maier Scholarship Fund, FAPMS Members' Dependents Award-
 Willie Cope's daughter
Bill Maier Scholarship Endowment -
 Marvin Boyer

Upcoming Meetings

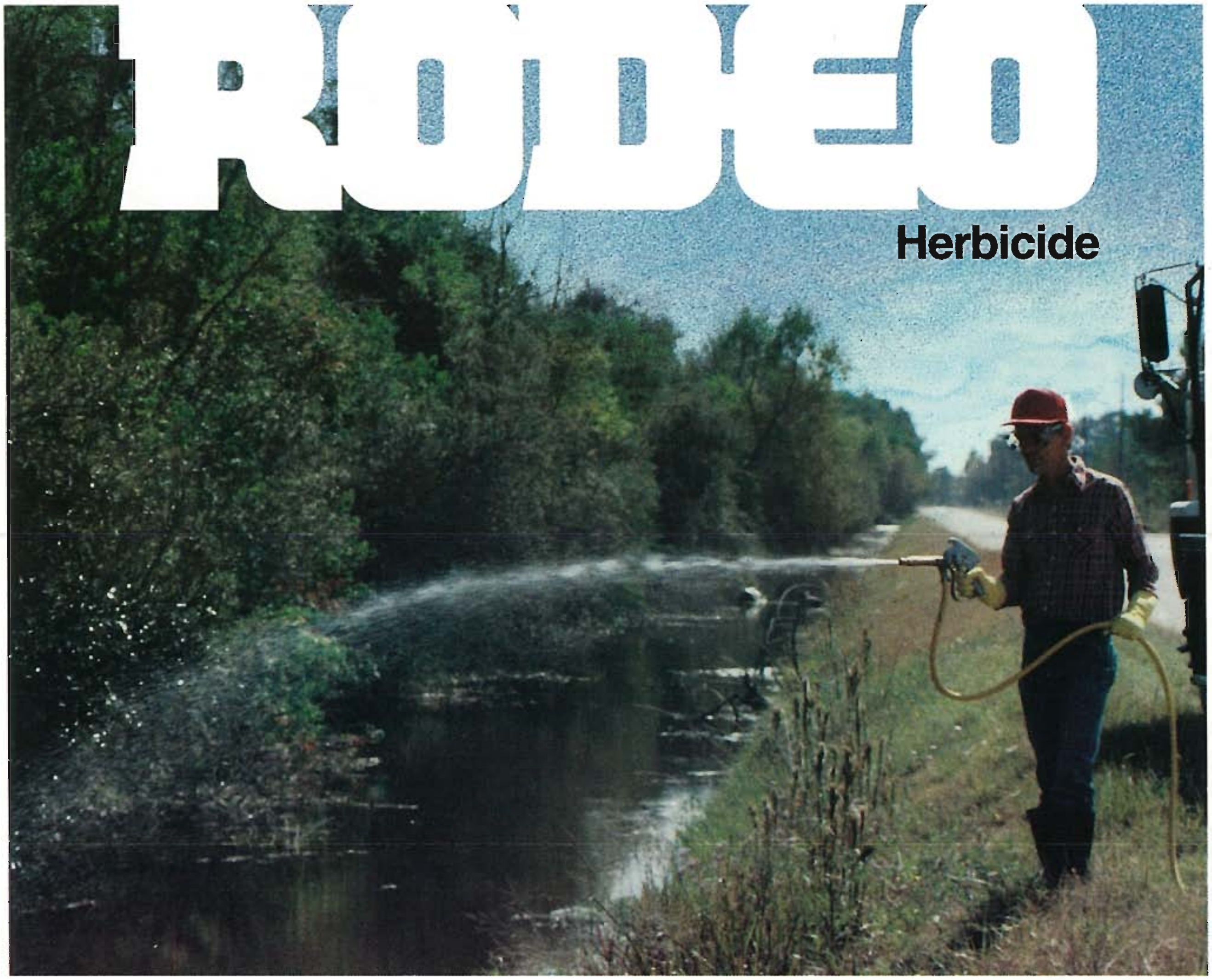
Feb 8 - 11 — Weed Science Society of America, Radisson Hotel, Denver. Contact: Lars Anderson, (916) 752-6260.

Mar 11 - 13 — North American Lakes Management 2nd annual southeastern lakes management conference. Contact: NALMS, (904) 462-2554.

May 13 - 14 20th Annual conference on wetlands restoration and creation, Sheraton Grand Hotel, Tampa, FL. Contact: F.J. Webb, (813) 757-2104.

May 30 - June 3 Joint meeting - Society of Wetlands Scientists and the American Society of Limnology and Oceanography, University of Alberta, Edmonton, Alberta, CANADA. Contact: Lyndon Lee, (206) 283-0673.

HOW TO CONTROL BRUSH AND WEEDS IN AND AROUND WATER.



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