

**THE AQUATIC
PLANT MANAGEMENT
SOCIETY, INC.**

**26th ANNUAL MEETING
ABSTRACTS**



**JULY 13-16, 1986
SARASOTA, FLORIDA, U.S.A.**

Aquatic Applicator's Financial Disaster - Liability Insurance

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1051 Douglas Avenue, Altamonte Springs, Florida 32701

Many aquatic applicators find themselves in a losing battle with the insurance world. Applicators that are able to find liability insurance coverage cannot afford the cost or the coverage deletes all pollution coverage. It is not uncommon to find applicators operating without liability insurance. Those that do have coverage find costs have increased several hundred percent and the amount of coverage has been reduced by fifty percent or more. Several case histories of insurance coverage and costs will be discussed. Possible alternatives and recommendations will be presented.

Sonar - Fully Labeled

David P. Tarver
Elanco - Eli Lilly
2416 McWest Street, Tallahassee, Florida 32303

Sonar was discovered in 1975 by Eli Lilly and for the past 10 years has been researched extensively, resulting in a full EPA registration. Sonar is a selective, systemic herbicide approved for all aquatic sites. Environmental safety, long term control and economics are advantages of this new product.

Roundup[®] Chemical Mowing on Ditchbanks

C. G. Erickson
Monsanto Company
Altamonte Springs, Florida

Field studies during the past 4 years with glyphosate at low rates have resulted in significant plant growth regulation of bahiagrass (Paspalum notatum) (Fluegge.) Rates of 0.15 to 0.21 kg ae applied 1 to 2 weeks after the initial mowing achieved 80 to 95% seedhead reduction and 30 to 70% foliar suppression for a period of 45 to 60 days. Sequential applications of 0.051 to 0.11 kg ae applied 45 days after the initial application extended further the seedhead control and vegetative suppression for over 90 days. Full season plant growth regulation without vital toxicity is the objective in order to supplant mechanical mowing and relatively high operating expenses on aquatic embankments and rights of way.

Aquatic Plants in Florida: Population Assessment and Management

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Approximately 500 lakes, rivers and canal systems covering 1.25 million acres of fresh water are annually surveyed in Florida for presence and abundance of aquatic plants. Of particular importance to the Department of Natural Resources are the exotic species which comprise nearly 38% of the vegetation in public waters. Management programs are designed to disperse roughly \$10 million annually administered by the Department for aquatic plant control using mechanical, biological and chemical means.

Seed Germination and Seedling Establishment of
Myriophyllum spicatum (Haloragaceae)

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Newly formed seeds of milfoil were collected from three plants in Pat Mayse Lake, Paris, Texas, and germinated under white, red, blue, green, and yellow light plus darkness. Germination was done on moistened filter paper and on sediment from the lake. Seeds also were germinated under a one-meter deep column of water. Seedling growth is being measured under different conditions. In April, 1986, seed germination and seedling establishment will be studied in situ at Pat Mayse Lake. The primary objective of this study is to learn if seeds are important to regrowth and spread of populations of milfoil.

Regrowth of Myriophyllum spicatum L. Harvested to
Several Depths in a Texas Reservoir

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Beds of Myriophyllum spicatum L. in Pat Mayse Lake Texas were hand-cut to 0.15 m, 0.3 m, 0.6 m, and 0.9 m below the water surface and rates of regrowth were determined. These beds were compared to a mechanically harvested area cut to 0.9 m below the water surface with good agreement of results. The results of this study suggest that rates of growth and regrowth for Myriophyllum spicatum L. are dissimilar.

Long-Term Effect of Harvesting on Eurasian Watermilfoil

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A double harvest was performed to control Eurasian watermilfoil for four years. Biomass, plant weight, and plant density were reduced by the harvesting program. Shoot and root carbohydrates were reduced in the spring but quickly recovered each season.

The Relative Effectiveness of 2,4-D and Endothall on
Myriophyllum heterophyllum

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The effectiveness of 2,4-D and endothall on Myriophyllum heterophyllum was measured in a Texas Reservoir. Six 0.10 ha plots were treated with either endothall (3.4 mg/L) or 2,4-D (3.2 mg/L). Three plots were used as controls. Biomass and water quality parameters were measured for three months. Significant differences in wet weight and ash-free dry weight between the endothall and control treatments were determined. No significant differences in biomass were observed between the control and 2,4-D treatments. The adequacy of biomass measurements in determining treatment dose will be discussed.

Biological Control of Water Lettuce

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A South American weevil Neohydronomus pulchellus and an Asian moth Namangana pectinicornis are the insects currently being considered for biological control of water lettuce in Florida. The weevil has been studied in quarantine and appears to be host specific. Results of the studies will be presented.

Duckweed Culture For Removal of NH_4 and For Reduction of
TSS from Algal Rich Waters

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Duckweed was cultured on outdoor ponds between January and May 1985 on algal rich waste water to evaluate ammonia and phosphorus removal rates, the reduction of suspended solids, and the biomass production. The maximum growth rate was $.21 \text{ kg/m}^2/\text{day}$ fresh weight; however, the production level fluctuated vastly. Overall, for this system, duckweed production was not compatible with the treatment of algae waste water.

Potential Management of Filamentous Algae by Photodynamic Action

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Filamentous algae species comprised the sixth most abundant aquatic plants encountered in Florida in 1984. *Lyngbya* species may be the most troublesome because of the tenacity, resistance to herbicide treatment, and the tendency to evolve troublesome compounds. Preliminary experiments indicate the possibility of control of *Lyngbya* sp. by selective photodynamic action. Various dyestuffs are considered, and a mode of action is described.

Experimental Trials with Integrated Control of Waterhyacinth

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Integrated pest management of waterhyacinth was tested at a 15 acre lake in Alachua County. Limited herbicide application was used in the fall to reduce a waterhyacinth weed mat by 70%. Existing waterhyacinth weevil populations were concentrated on the remaining weed mats and allowed to overwinter. Evidence of increased feeding damage was seen in the spring.

Deficiency Symptoms and Calcium Nutrition of Waterhyacinth

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Interest in waterhyacinth (*Eichhornia crassipes* (Mart.) Solms.) has increased due to its use in nutrient-removal in wastewater treatment systems. Optimal waterhyacinth growth is not always obtained, due to variations in wastewater nutrient quality. Studies of waterhyacinth grown in various nutrient-deficient media have resulted in a description of deficiency symptoms for several elements. In addition, results indicate the essentiality of calcium (in the range 10-30 ppm) for optimal waterhyacinth production.

Proximate Oxygen Demand of Three Aquatic Macrophytes:
Use in Management of Aquatic Systems

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Oxygen consumption rates, specific oxygen consumption and decay rates were measured and compared for three species of aquatic macrophytes, *Eichhornia crassipes*, *Potamogeton diversifolius*, and *Myriophyllum spicatum*. The decay half-life for *M. spicatum* was 10.04 days and for *P. diversifolius* was 23.25 days. *E. crassipes* was somewhat slower to decay with a half-life of 48.12 days and a greater specific oxygen consumption of $5.53 \text{ mg O}_2/\text{mg}$ plant material. These measurements can be very useful in anticipating declines in dissolved oxygen below critical levels following herbicidal treatments or cutting.

Fate of Glyphosate in Alligatorweed (*Alternanthera philoxeroides*)

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The fate of ^{14}C -glyphosate was studied in alligatorweed to determine its mode of resistance to the herbicide. ^{14}C was distributed at concentrations representing glyphosate that is lethal to certain plants, but in much lower amounts than are translocated in many other susceptible plants. This suggests that alligatorweed tolerance to glyphosate is a combination of limited translocation and glyphosate metabolism. Preliminary data suggests that glyphosate is metabolized to other products in alligatorweed.

Seed Production by Monoecious Hydrilla

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Hydrilla (Hydrilla verticilla) was first identified in North Carolina lakes in 1979. All of the hydrilla populations thus far discovered in North Carolina are the monoecious strain. This strain produced eight seeds per sq. meter in November 1985. Three seeds per sq. meter appeared to be mature. Those seeds that appeared mature were found to have twenty percent viability when germinated indoors in aquaria. Mature hydrilla plants have been grown from seedlings.

Field Test of Granular Aquatol on Hydrilla in Gatun Lake, Republic of Panama

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Three treatment rates, i.e., 112, 224, and 449 Kg a.e./ha of granular Aquatol were tested at three different areas - Dump-2, Dump-4, and Tabernilla, of Gatun Lake, Republic of Panama. Treatment of copper sulphate crystals at a rate of 20 ppmw, and a control plot provided the basis for comparison at every location. Effects of granular Aquatol were detected 72 hours after the application in two areas, and 7 days were necessary to detect only slight decline of hydrilla in Tabernilla area at all treatment rates. It was determined that maximum reduction of hydrilla was obtained 21 days after application in most cases, the exception being treatments in Tabernilla area, in which maximum reduction was obtained 42 days after application.

The Response of Hydrilla to Various Concentrations and Exposure Periods of Selected Aquatic Herbicides

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Investigations of the relationships between herbicide concentrations and time responses are currently in progress in order to evaluate the potential of diquat, endothall, and fluridone for control of hydrilla in flowing water. Discussion will be focussed on: 1) time-course uptake characteristics, 2) critical (lethal) tissue concentration, and 3) minimum effective contact time.

Identification of Hydrilla verticillata (L.f.) Royle Strains by Means of Isoenzyme Patterns

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In 48 strains of Hydrilla verticillata (L.f.) Royle, collected in areas all over the world, isoenzyme patterns have been studied. There was a large variation and a total of 24 different multi-isoenzyme phenotypes could be observed. It has been suggested that isoenzyme analysis is a useful tool to identify different Hydrilla strains as distinguishing them on the basis of morphological characteristics is hardly feasible, particularly as the plants vary considerably under the influence of environmental factors.

The Application of Genetic Engineering Technology for Aquatic Plant Management

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A long term research effort to investigate genetic engineering technology for management of submerged aquatic macrophytes (Myriophyllum spicatum and Hydrilla verticillata) is in progress. The first phase is the identification of microorganisms that are specific to the target plants. These microorganisms will be genetically engineered to include specific traits (e.g. toxin production, degradative enzymes, etc.), which are lethal to the plants. A committee of experts has been established to provide technical and regulatory guidance.

A Method for Evaluating Growth of Hydrilla in Lake Sediments

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Growth of hydrilla was compared for plants cultured in sediments processed as 'moist' and 'dry'. Dry weight of plants were higher for 'dry' processing than for the 'moist'. Growth of hydrilla in sediments collected from the Kissimmee Chain of Lakes indicated considerable differences in the potential of these lakes to support growth of hydrilla.

Experimental Analysis of Interference Between
Monoecious Hydrilla and Sago Pondweed

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The potential for interference between hydrilla (monoecious, NC) and sago pondweed was evaluated using a replacement experiment. The results indicate that when grown in a nutrient poor substrate there was little evidence of interference, irrespective of initial sago pondweed tuber size. However, plants grown in a richer substrate, exhibited clear evidence of interference. Relative yield of sago pondweed from larger tubers was less affected by hydrilla than that for plants from smaller tubers.

Use of Synthetic Cytokinins to Inhibit Tuber and
Turion Production in Hydrilla verticillata Royle

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The synthetic cytokinins Thidiazuron (Nor-Am), AC239,604 (Am. Cyanamid), AC243,654 (Am. Cyanamid), and AC271,904 (Am. Cyanamid) were tested for their effects on growth and propagule formation in algal free cultures of hydrilla. Thidiazuron, AC239,604 and AC271,904 effectively inhibited propagule formation at concentrations in excess of 10^{-6} M. Data from AC243,654 indicated a trend in reduction of propagule formation but was not 100% effective even at 10^{-4} M. Concentrations that inhibited propagule formation also caused extensive branching and growth of lateral buds.

Herbicide Residue Monitoring in Potable Waters Following
Applications of Sonar and Diquat

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Sonar was applied to two lakes 12 km and 6 km upstream of a potable water intake to control spreading hydrilla infestations. Diquat was applied to two canals located near the water intake to control waterhyacinths. Residue analyses detected Sonar for 50 days and at least 12 km downstream of treatment sites. Diquat analyses are not complete at this writing.

The Triploid Grass Carp - A Tool for Aquatic Plant Management

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The development of the sterile, triploid grass carp provides the State of Florida and the nation with a sound, cost-effective tool for aquatic weed control for many types of aquatic ecosystems. However, if the triploid is to be used in aquatic plant management, emphasis should be placed on stocking rate, target plants and large usage.

Efficacy of Triploid Grass Carp in Central Florida Lakes

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Nineteen lakes ranging from 0.6 hectares to 42.1 hectares were stocked with triploid grass carp (Ctenopharyngodon idella) at rates of eight fish per hectare to 370 per hectare. In the majority of lakes the target plant was hydrilla (Hydrilla verticillata). However, two lakes were primarily southern naiad (Najas guadalupensis) and two others were Brazilian elodea (Egeria densa). The higher stocking rates were successful while the lower rates gave mixed results. Several areas were stocked in conjunction with herbicide treatments in which all stocking rates used were successful.

Utilization of Triploid Grass Carp for Control of
Floating Vegetation in Waste Water Retention Ponds

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Triploid grass carp (Ctenopharyngodon idella) were stocked into waste water ponds covered by duckweed (Lemna sp.). Estimates of floating vegetative biomass and water chemistries were obtained on a regular basis. Tank studies determined that triploid grass carp ($X_{TL}=150$ mm) would consume at least 2.5 times their body weight in duckweed per day; this information along with estimates of duckweed growth rates will allow a stocking model to be constructed. Such a model will permit waste water treatment plant managers to reduce their budgets and time expenditures on controlling floating vegetation in retention ponds.

Production of Triploid Grass Carp

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Triploid grass carp (*Ctenopharyngodon idella*) were produced by application of various chemical, cold or heat shocks to grass carp eggs at different time intervals after physical fertilization and varying durations. Up to 87% of grass carp produced in some spawns were triploids. The optimum treatment was to expose eggs, one minute after mixing milt and roe, to an instantaneous temperature increase of 12°C above ambient (26°C), for a duration of 3.5 minutes.

The Use of Hormone Induced Spawning Techniques to Test the Sterility of Triploid Grass Carp

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During April 1986, 21 triploid grass carp and 18 diploid grass carp received human chorionic gonadotropin and carp pituitary injections to induce spawning. 1983 triploids ranged from 2.5 to 5.5 kg. 1981 diploids were between 3.0 and 6.7 kg. Milt volume was similar for diploids and triploids, but density was lower with triploids. No eggs were collected from triploid females. Back crossing triploid males and diploid females resulted in fertilization, embryo development, and some hatched fry.

Preferential Feeding by the White Amur in a Reservoir Embayment

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In September 1984, grass carp were stocked at a rate of 45 fish/weed infested hectare in a screened embayment on Guntersville Reservoir in northeastern Alabama. During the 1985 growing season, naiads and other annual aquatic macrophytes in the shallow water drawdown zone disappeared in response to an apparent feeding preference for these species. Standing crop of Eurasian watermilfoil decreased significantly, although areal coverage increased primarily as a result of curtailment of herbicide treatment within the study area.

Management of Hydrilla and Other Aquatic Weeds in Agricultural Canals with Triploid Grass Carp

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Triploid grass carp in combination with mechanical methods to create refuge areas in dense mats of hydrilla were effective in controlling hydrilla and other aquatic weeds in agricultural canals.

Spring Production of Monoecious Hydrilla Tubers and Turions

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Previous studies at this and other laboratories have shown that short days (<13 h) stimulate the formation of tubers in both monoecious and dioecious hydrilla. Short days in early spring therefore may lead to tuber formation, particularly in the monoecious biotype since it is capable of producing tubers within 4 to 5 weeks. We found that replicated outdoor cultures of monoecious hydrilla at Davis, California planted in January - March (from tubers) produced subterranean tubers, axillary turions and turions on the tips of above-ground shoots ("stem turions") by April. For example, one culture had ca. 1.2 tubers and 5.9 turions per plant by the end of March. The implications of these findings for control strategies will be discussed.

The Allelopathic Potential of *Brasenia schreberi*.

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Brasenia schreberi, common name water-shield, are submersed, aquatic dicotyledonous plants which are native to Mississippi. Water-shield is not an exotic or imported plant species, yet when it is introduced in an area, it rapidly becomes dominant. Water-shield appears resistant to attacks by pathogens and herbivores with the exception of attack on the upper leaf surfaces by leaf miners. Water-shield obviously possesses defenses which allow it to remain relatively disease-free and to become the sole occupant of its habitat. The most likely defense mechanism of water-shield is the accumulation of toxic secondary products (allelopathy). Tests of extracts of water-shield show it to be allelopathic.

Ethanol extracts of water-shield were tested in an agar-paper disk assay system involving 9 different bacteria as challenge organisms. The extracts exhibited varying degrees of inhibition toward these 9 challenge organisms. Water-shield extracts also exhibited activity in lettuce seedling growth inhibition bioassays, a classic measure of allelopathic potential. This paper will discuss the results of these assays.