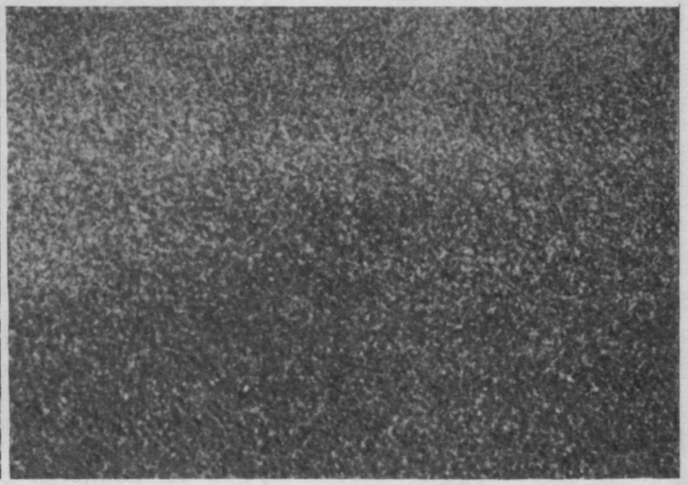
When dollar spot hits, here's how new systemic MERTECT® 140-F flowable saves your turf, time, and money.

Untreated dollar spot disease



Treated with MERTECT 140-F

These pictures show the kind of dollar spot control you get with new flowable MERTECT 140-F. Even against cadmium-resistant strains. It also works well against brown patch and *Fusarium* patch.

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Just follow the label instructions. MERTECT 140-F is not phytotoxic to grasses when used as directed. Your Merck distributor has new flowable MERTECT 140-F now. If you don't have his name, write us. Agricultural Products, Merck Chemical Division, Merck & Co., Inc., Rahway, N.J. 07065.

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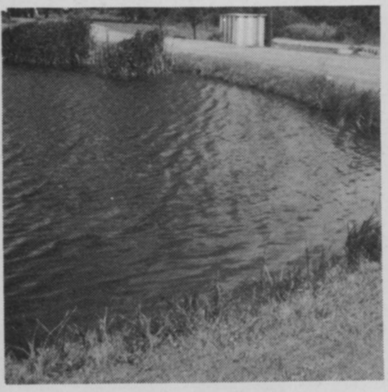

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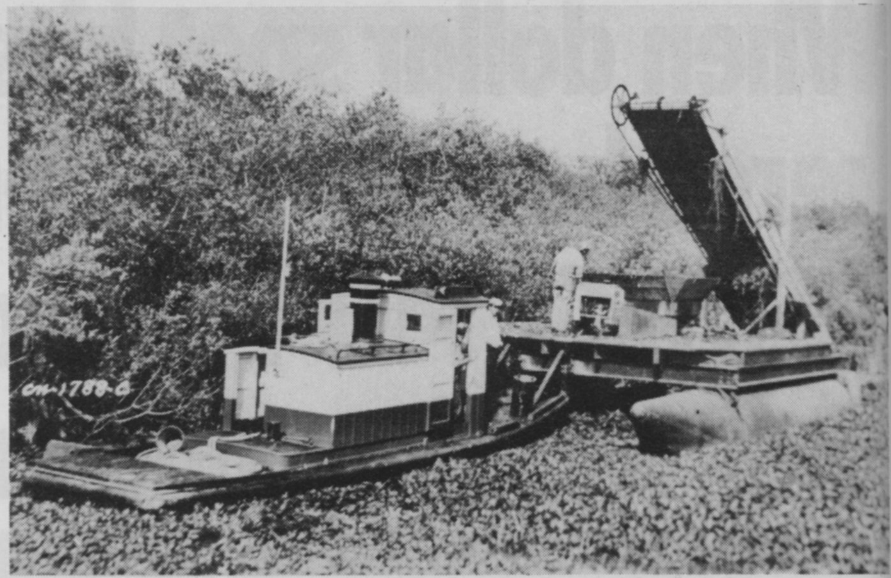


Operating in a sea of hyacinths, this conveyor and dipper are making a trial run in a small canal. Photo was taken in the 1930's.

AQUATIC WEED HISTORY *(from page 12)*

3. Fowler's solution
4. Arsenite of soda
5. Copper sulfate
6. Potassium bichromate
7. Potassium ferrocyanide
8. Crude carbolic acid
9. Potassium hydrate
10. Sulfocarbolic acid
11. Chlorinated lime
12. Bichloride of mercury
13. Monochloride of mercury
14. Lugal's solution of iodine
15. Terpene
16. Oil of tar
17. Tannic acid
18. Aqua regia
19. Kerosene emlusion
20. Whale-oil-soap solution
21. Formaldehyde, 40%
22. Creolin and chloronaphtholeum
23. Sulfurous acid

The first six of these were found to be effective. All of these were also toxic to cattle. Experiments were then conducted to find a repellent which would prevent cattle from eating sprayed plants. Only one effective repellent was found, but the cost was prohibitive.

Sodium arsenite was utilized in Louisiana until 1937. It was abandoned because of cost considerations favoring destruction by machines, defects in effectiveness of the chemical treatment and the demonstrated dangers of this chemical.

Needless to say, the most elementary method of removing hyacinths is to drag or throw them onto the bank. One successful method used was "the elevator", a barge-mounted piece of equipment in which hyacinths are pulled or pushed onto an endless-belt conveyor which lifts them from the water and deposits them on the bank. Barge-mounted equipment with a boom and forked grapple has also been used to deposit the plants on shore. In small canals, draglines with grapples or rakes have also been used.

In 1937, the hyacinth destroyer, "Kenny", a 135 ton, self-propelled, diesel electric, crusher boat was put in operation in the New Orleans District. Vegetation was lifted from the water as the vessel advanced and deposited in a hopper from which it was fed between two rollers operated under 40,000 pounds pressure. The refuse was then returned to the water where it would sink to the bottom. This method resulted in almost complete kill of the plants that passed through it, but its effective use was limited to water deep enough to float the equipment and to areas where hyacinths were massed over a considerable area to feed the machine continuously and in large amounts.

About the same time, the most effective mechanical destroyer in Florida was the "sawboat." This was a specially built boat consisting of three sets or banks of cotton-gin circular saws spaced five-eighths of an inch apart, one bank about six feet in width mounted at the front and one bank on each side about three feet in width. These banks could be raised or lowered. The saws were spun at high speeds and were used to propel the boat. Areas were usually cut about four times to thoroughly macerate the material.

In Louisiana, barges were utilized to perform the same type operation.

Needless to say, the advent of 2,4-D, with its effectiveness, safety, ease of application, and value for control of water hyacinth and other obnoxious aquatic plants was recognized by the Congress when it authorized a separate Expanded Project for Aquatic Plant Control covering the eight Gulf and South Atlantic States, PL 85-500, 85th Congress, approved July 3, 1958.

That law authorized a comprehensive program to provide for control and progressive eradication of the water hyacinth, alligatorweed and other obnoxious aquatic plant from the navigable waters, tributary streams, connecting channels, and other allied waters in the combined interest of navigation, flood control, drainage, agriculture, fish and wildlife conservation, public health and related purposes including continued research for development of the most effective and economic control measures.

Subsequent amendments, Section 104 of the River and Harbor Act of 1962 and (76 Stat. 1173, 1180) and Section 302 of the River and Harbor Act, Approved 27 October 1965 (79 Stat. 1092) authorized Federal funds for research and extended the program from the Gulf and South Atlantic States to the United States.

In retrospect, the history of obnoxious aquatic plants in the Southeast over thepast 70 years has been related to operation programs of the Corps of Engineers. Much of the research, both chemical and biological, that has been accomplished to date was actually initiated in 1960 under the Expanded Program for Aquatic Plant Control.

Since that time, private industries, State and local agencies have also conducted a large part of the research activities in the field of aquatic plant control.

It is our hope that through the combined efforts of all concerned, the means for control operations can be found that will ultimately lead to the progressive eradication of obnoxious aquatic plants and at the same time provide for the protection of man's environment.

References

1. H. D. No. 27, 85th Congress, 1st Session, "Water Hyacinth Obstructions in the Waters of The Gulf and South Atlantic States," 1958.

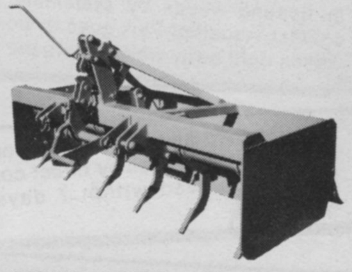
2. Bulletin No. 18, Division of Botany, April 5, 1897, U.S. Department of Agriculture.

3. H. D. No. 251, 89th Congress, 1st Session, "Expanded Project for Aquatic Plant Control," 1965.

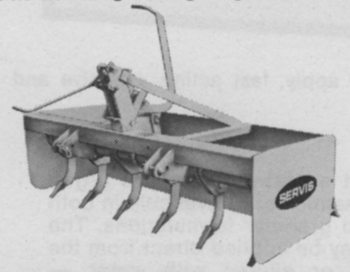
These box scrapers mean business!

All ten models are built to move heavy loads quickly with minimum power and effort. Curved blades cut and roll soil into maximum loads. Lifting mechanism and scarifier assemblies are designed with higher front end clearance for larger intakes. The exclusive structural design of all Servis deluxe box scrapers provides direct support from the draw link connection to the rear moldboard to prevent warping or bending. See your dealer for the Servis box scraper that best fits your requirements . . . and make fast, easy work of all future soil moving jobs!

HYDRAULIC models (66", 72", and 84") feature a positive mechanical lock to eliminate any stress on the cylinder, even when scarifiers are cutting the toughest ground.



AUTOMATIC LIFT-TRIP models (66" and 72") feature scarifiers that automatically lift and lock when the box is raised. Trip lever drops teeth back into cutting position.



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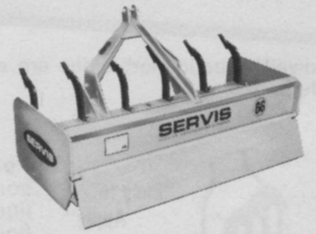

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ity for our recreational enjoyment. This requires an intensive research program and orderly system of toxicological screening and evaluation of all chemicals and biological components of the aquatic ecosystem.

Our research activity routinely concentrates on 1) acute and chronic toxicity of all life stages of fish, fish food organisms, and aquatic flora; 2) fate of residues, degradation products, and their biological significance; 3) conditions affecting toxicity, efficacy and persistence, 4) interaction with other chemicals, components of aquatic ecosystem or physical conditions; and 5) alternatives for biological, cultural, or integrated control methods. (See Figure 1, page 40) As the major resource management agency concerned with aquatic habitat improvement, this information generated by research is required for adequate pesticide labeling, recommendations, and guidelines for safe and effective use of chemicals, biological or integrated control systems.

We have repeatedly demonstrated the more persistent organochlorine insecticides are more toxic than organophosphorus insecticides to fish. Our Fish-Pesticide Research Laboratory also finds that fish-food organisms are quite sensitive to many kinds of pesticides. Field studies confirm these data to a reasonable extent when degradation and exposure-contact time are fully appreciated. With this in mind, biologists are understandably alarmed over decisions to use pesticides and pest control programs when the consideration is cost-effectiveness relative to the pest and safety to humans without recognition of toxicity and residue problems threatening fish and wildlife. Biologists as Rachel Carson have been accused of being emotional and unscientific in their attack. Consequently, many studies on the toxicology of pesticides have been challenged or ignored by those responsible for administrative decisions in the use or labeling of pesticides. We welcome the critical examination of these studies, but we also insist on an equally critical examination of proof that the pest control program *will not adversely affect fish and wildlife.*

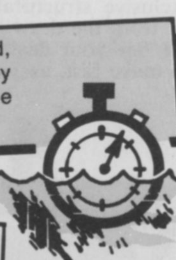
Also, we insist that where mounting evidence demonstrates many of these pesticides to be undesirable or suspected contaminates of the environment, we should call a halt to their use until proven safe. This applies particularly to those uses in or around aquatic sites since residues have repeatedly shown up in fish and invertebrates. This is most serious for those chemicals that tend to accumulate in high concentrations in fish-food organisms and fish tissues. Biological transfer of pesticide residues, especially in resistant species, from lower food chain organisms up the food chain to fish, also has been well documented. The most resistant individuals that survive are subject to accumulation and transference of pesticide residues to other members of the ecosystem and to man. The resulting chronic toxicity and residues depreciates the productivity of fish and the value of the fishery — these effects are often subtle and unnoticed. More recently, our attention has turned to the organophosphorous and carbamate insecticides and their interaction with organochlorine pesticides and other compounds such as plasticizers like phthalate esters and PCBs (Polychlorinated biphenyls). These chemicals can kill fish outright, result in tissue residues or cause pathology

(continued on page 40)

THREE ECONOMICAL WAYS TO CONTROL WATER WEEDS AND/OR ALGAE

Select the aquatic herbicide to meet your needs . . .

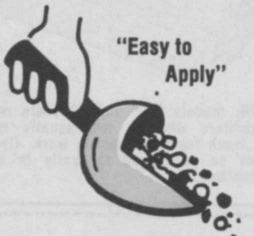
Aquathol-Plus® kills 24 different submerged, emerged, or floating weeds by systematic action as well as by contact. Aquathol-Plus goes to work at once, killing some weeds right away while others die in 2 to 4 weeks.



Aquathol K® kills 15 of the most common submerged water weeds by direct contact. Weed control is achieved within 7 days under normal conditions.

Hydrothol® is a wide-spectrum algaecide—and herbicide — effective against chara and many algae that cause problems in lakes and ponds as well as drainage canals.

Pennwalt Aquatic Herbicides are easy to apply, fast acting, effective and biodegradable.



Pennwalt aquatic-weed and algae control chemicals are available in both liquid and granular formulations. The liquids may be applied direct from the container or diluted with water — either as a surface spray or injected under the water. Granular products can be applied by air, with various types of mechanical spreaders, or broadcast by hand scoop.

Aquatic herbicides are the most effective, economical, and generally, the easiest method for controlling unwanted weeds and algae.

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BEETLE CONTROL DED ANSWER

Reference is made to the article in WEEDS TREES AND TURF — April 1972 entitled "Dutch Elm Disease-One step Closer To A Cure."

Benomyl and other things cited as potential cures or controls for DED fail to recognize the fact that even if Benomyl prevented or over came current infections there is nothing to prohibit the tree from being infected or reinfected.

In spite of current opposition to the use of pesticides there is only one promising approach, in my opinion, and that is to prevent the vector beetles from feeding on healthy trees. In other words emphasis must be placed on beetle control which today is only accomplished by the application of DDT or other long residual insecticides. Applications of DDT by helicopter has shown good to excellent protection, and little if any evidence exists of this causing harm to other forms of life.

Tree sanitation in which weak or broken limbs and trees are removed before beetles bred in them has shown to reduce the beetle population, but this has to be done on an area basis to be effective.

An unexplored area is to radiate and sexually sterilize the beetles. This might then be used as in the case of the screw worm to control the beetle and at the same time the disease. **William D. Buchanan — Entomologist, Brigham Young University, Provo, Utah.**

ACUPUNCTURE HURTS

Little items like the one on page 64 of the May, 1972 issue of WEEDS TREES AND TURF on "Acupuncture for Dying Elms" can do nothing but set plant pathology back at least 20 years. **Lester P. Nichols, Professor Plant Pathology Extension, Penn State University**

SET RECORD STRAIGHT

I was interested to read the article in your May, 1972 issue entitled "Ultra Violet Light Helps De-code Ryegrass Species". The article is timely and most points are well taken. However, I would like to make specific objection to the portion in the article by Dr. Henry W. Indyk concerning the Canadian variety Norlea Perennial Ryegrass.

Dr. Indyk mentions dissatisfaction with the turf performance of Norlea due to a contamination of the seed with inferior Ryegrasses.

The performance of any variety can be severely compromised if the seed contains ad-mixtures of any other crop or weed species, but this condition should not reflect on the usefulness of the variety but rather on the seed grower who produced the seed and the production area.

Oseco Limited is the largest distributor and exporter of Norlea Perennial Ryegrass. Our production fields are carefully controlled to ensure no contamination of inferior Ryegrasses as evidenced by analysis tests on all our 1971 crop which showed 0.0% fluorescence.

Dr. Indyk's comments reflect poorly on the usefulness of the Norlea variety and we would be grateful if you would set the record straight. **G. Eros, general manager, OSECO LIMITED.**

REBUTTAL

Mr. Eros' . . . statements made in reference to Norlea ryegrass in my portion of the article are understandable. The statements made are fact and were used as a classical example to illustrate what can happen with a good variety that has taken a great deal of effort to develop. The intent was not to condemn the performance of the variety. He fails to mention that a statement was made relative to its proven performance. Also, perhaps unknown to him, New Jersey was among the first in the United States to recognize the superiority of Norlea to other ryegrasses available at that time and on this basis, it was included in our recommendations. . . . **Henry W. Indyk, Specialist in Turfgrass Management, Rutgers University.**

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AQUATIC HERBICIDES — NEW POSSIBILITIES

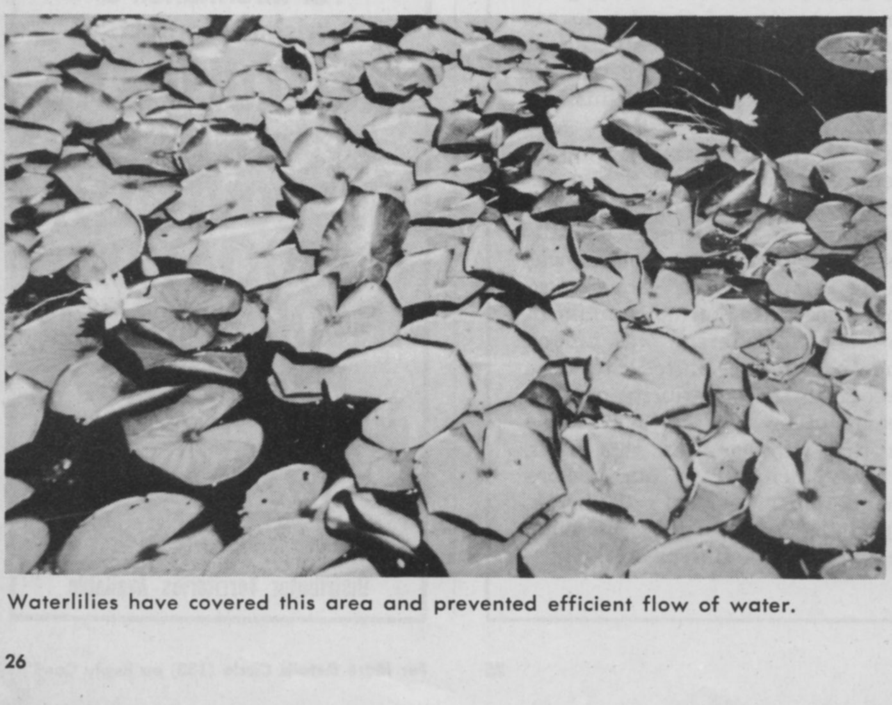
By DR. ROBERT C. HILTIBRAN
Associate Professor of Agronomy
University of Illinois

SINCE about 1967 the development of aquatic herbicides has been considerably curtailed. This has been due in part to the collection of data which indicates that some pesticides, primarily the organo-chloro insecticides, have been accumulating in various segments of the environment and have been producing various undesirable effects.

Further, a recent report indicates that 2,4,5-T formulations when fed to rats at high rates cause teratogenic effects. A general awareness has developed that the chemical age is introducing agents into the environment that are detrimental to the environment. Since these reports implicate pesticides, the registration of many aquatic herbicides have been reevaluated.

Furthermore, additional research efforts are required which increased the cost of development of aquatic herbicides. Aquatic herbicides have a rather limited monetary return and the increased costs have resulted in reduced developmental work on new aquatic herbicides. In fact, additional data is now required to support the continued use of aquatic herbicides.

At this point, there is little evidence which indicates that aquatic herbicides have been detrimental to the aquatic environment or that residues have been accumulating, except for arsenic and copper. However, sodium arsenite and copper sulfate have been widely used for the control of submersed aquatic plants and algae, respectively. Since arsenic and copper are metals, only the chemical composition of these metals can change and these will accumulate within the aquatic system. To date, there has not been any indication that in ponds and lakes the bottom soil accumulations of arsenic and copper have been detrimental. There are reports that copper has decreased fish production.



Waterlilies have covered this area and prevented efficient flow of water.

Aquatic heribicides containing arsenic or copper should not be classed with the organic-type aquatic herbicides such as endothall, diquat or 2,4-D, since the latter apparently undergo decomposition to various products which may be metabolized further and become part of the carbon component within the aquatic system. It should be pointed out that while 2,4-D and silvex are organo-chloro herbicides there is indication that these compounds are being degraded and they have not accumulated in any segment of the aquatic environment.

In several recent studies at the Natural History Survey it was found that the butyl ester of 2,4-D, which is toxic to fish, did not appear to have any direct toxicity to several bethnic organisms and the 2,4-D was rapidly removed from the water. Usually some ester or salt derivative of 2,4-D is used in the herbicide formulations. The esters of 2,4-D are more toxic to fish than salts.

In our laboratory we observed that 2,4-D and 2,4,5-T (acid) were not readily absorbed by bluegills. It has been shown that the butoxy ethanol ester of 2,4-D was more readily absorbed from water than the 2,4-D acid; however, the esters of 2,4-D and silvex were rapidly hydrolyzed within the aquatic environment. This indicates that fish exposed to an application of an aquatic herbicide containing 2,4-D or silvex would not accumulate much 2,4-D or silvex since the exposure of the fish to the esters would be very short; even with a longer period of exposure to the acid, little would be absorbed by fish.

This further suggests that any contamination of an aquatic environment with a herbicide containing 2,4-D, 2,4,5-T or silvex would not present a great potential for hazard, since the esters would be rapidly hydrolyzed and fish would be exposed longer to the acid form. This does not mean that trouble could not develop, when extreme excesses of phenoxy herbicides entered the aquatic environment. But potential danger would be minimized.

The Natural History Survey continues to investigate the effects of available aquatic herbicides and to attempt to develop techniques for the control of aquatic plant species which have been difficult to control.

One such species is spatterdock, *Nuphar advena,* a member of the waterlily family. Spatterdock is quite common in the southern part of Illinois. It had been reported to be controlled by the use of granular 2,4-D. However, I was advised that spatterdock was not being controlled with 2,4-D. Thus, we investigated the effect of 2,4-D, 2,4,5-T and silvex on spatterdock over a two year period and although a severe reduction in the stand occurred, the plants were not eliminated from the treated areas.

During the summer of 1968, we learned that a post emergent application of dichlobenil (Casoron) was effective against spatterdock. In late summer we applied dichlobenil against spatterdock and the plants were severely damaged. Unfortunately we could not continue these observations the following spring nor make early spring applications of Casoron on spatterdock.

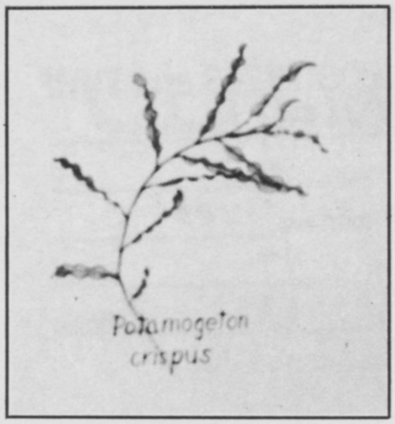
Recently it was reported that postemergence applications of dichlobenil on waterlilies at rates of 5 lb ai/A applied during periods of active growth in June and July gave excellent results, and that spatterdock was controlled with applications of 8-10 lb ai/A. Since dichlobenil has been registered for preemergence use only, the Thompson-Hayward Company is seeking a change in the registration to include these postemergent uses of dichlobenil for spatterdock and waterlily.

Spatterdock, also known as yellow waterlily or cowlily, has a broadly notched leaf a little longer than wide. The lobes are somewhat pointed, spreading from a 45 to 80° angle. The petiole, or leaf stalk, holds the leaves nearly erect. However, the leaves may float on the water surfice. It has a yellow flower and a somewhat globular fleshy fruit containing many seeds. Spatterdock has an underground thick, spongy root stock or stem which has to be killed for control of plants.

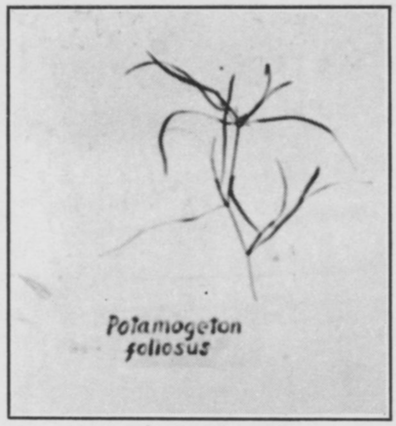
Another species which had not responded to suggested rates of herbicide applications was water stargrass, *Heteranthera dubia.* Water stargrass, also called mud plantain, has ribbon-like leaves and the stems and leaves are long and flexible and trail through the water. Water stargrass closely resembles a submersed *Potamogeton* spp. but can readily be distinguished from them by the lack of a definitive mid-vein in the leaves, and, in the late summer, by the characteristic yellow star-like flower.

(continued on page 30)

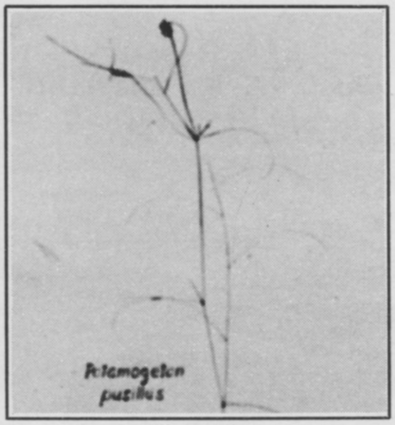
COMMON AQUATIC WEEDS



Curlyleaf Pondweed

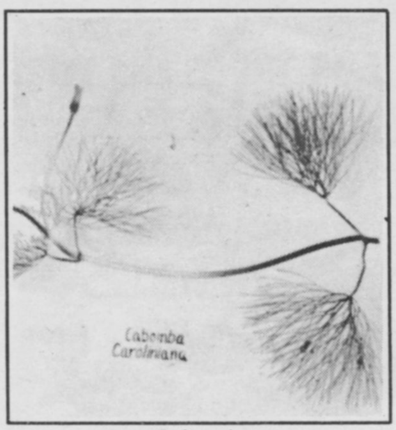


Leafy Pondweed

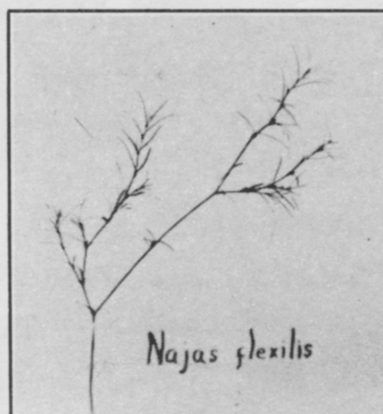


Small Pondweed

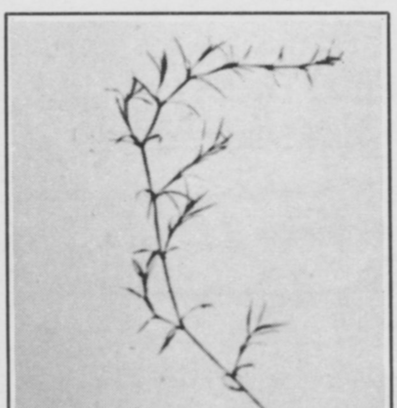

Waterstar grass

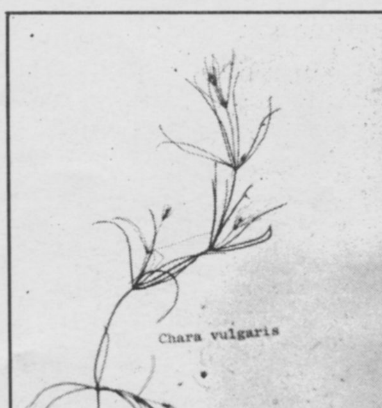


Cabomba



Slender Naiad


Southern Naiad



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ILLINOIS RESEARCH *(from page 27)*

Sodium endothall was reported to have controlled water stargrass at rates of 2 to 3 ppm. Data from southern Illinois indicated that water stargrass was not being controlled by sodium endothall at high rates. We found that diquat cation (Diquat) at 1 ppm and potassium endothall (Herbicide 273) at rates of 5 ppm eliminated water stargrass from the treated areas. *Note — We did not apply sodium endothall against water stargrass for comparison. Hence, the potassium salt of endothall must be used for water stargrass control.)*

Some of our early investigations on the control of cabomba, *Cabomba caroliniana* using granular 2,4-D or silvex were not successful. Later investigations indicated that cabomba was eliminated from the test areas using the granular isooctyl ester of 2(2,4-dichlorophenoxy) propionic acid. However, 12 weeks were required before the cabomba plants were eliminated.

We have continued our interest in the control of cabomba and reinvestigated the effects of granular 2,4-D and silvex on cabomba. While we have not obtained real definitive data, our results suggest that granular 2,4-D and silvex suppress or retard the development of cabomba during the growing season. Cabomba develops late in the growing season

(continued on page 32)

Table 1. Various aquatic weeds controlled with aquatic herbicides in tests conducted by the Illinois Natural History Survey.

Group and Species	Chemical, active ingredient or free acid equivalent	Experimental or Tested Rate of application	Remarks
EMERGENT			
Spatterdock *Nuphar advena*	dichlobenil	6 lb ai/A 3 lb-4% Granules* per 440 ft^2	Spread on the water surface
Waterlilies *Nymphaea* spp.	dichlobenil	5 lb/ai/A	Spread on the water surface
SUBMERSED PLANTS WITH ALTERNATE LEAF ATTACHMENT			
Curlyleaf Pondweed	Hydrothol-47 (L) (di-N,N,-dimethylcoco-amine salt of endothall)	0.5 ppm (endothall content)	Apply on or below the water surface
Potamogeton crispus	diquat copper-triethanolamine complex	0.25 ppm diquat equal volume of copper-triethanolamine complex	Apply or or below the water surface
	Hydrothol-47 (10% G)	100 lb/A	Spread on the water surface
Leafy Pondweed *P. folious*	Hydrothol-47 (10% G)	100 lb/A	Spread on the water surface
Small Pondweed *P. pusillus*	Same as for leafy pondweed	100 lb/A	Spread on the water surface
Waterstar grass	diquat cation	1 ppm or 2 gal/ surface A	Apply on or below water surface
(Heteranthera dubia)	endothall potassium salt (4 lb/gal or 10% G)	5 ppm	Apply on or below water surface
SUBMERSED PLANTS WITH WHORIED OR OPPOSITE LEAF ATTACHMENT			
Cabomba *Cabomba caroliniana*	2,4-D ester (20% G)	2-3 lb/440 ft^2 200-300 lb/ surface A	Apply on or below water surface
Slender Naiad *Najas flexilis*	Hydrothol-47 (L)	2 ppm (endothall content)	Apply on or below the water
Southern naiad *N. quadalupensis*	Hydrothol-47 (L)	2 ppm (endothall content)	Apply on or below the water surface
ALGAE THAT RESEMBLE TRUE PLANTS			
Chara *(Chara spp)*	Hydrothol-47 (10% G) copper-triethanolamine complex	100 lb/surface A 0.5-1 ppm	Spread on the water surface
ALGAE			
Filamentous	Hydrothol-47 (10% G) copper-triethanolamine complex	100 lb/surface A 0.5-1 ppm (copper content)	Spread on the water surface

*The formulation currently available may contain 10% dichlobenil.

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