to levy a tax of up to one-fourth mill on all taxable property in the county. In addition, two agencies, the State Game and Fresh Water Fish Commission and the Central and Southern Florida Flood Control District, have agreed to supplement the District's budget with funds they normally would spend in Lee County. Each of these agencies has agreed to make available at least as much money as it has expended in our area in the past. When funds from these two agencies were added to the revenue produced by the one-fourth mill tax, the budget adopted for the fiscal year October 1, 1961, through September 30, 1962, totaled $115,129.19.

While this is our first year of operation, we feel certain that progress will be rapid since we do have the personnel know how and plant facilities of the local mosquito control district to fall back upon. However, it is the intent of the law, and ours, that the Lee County Hyacinth Control District, as an independent agency, will operate a program which can provide adequate control of this obnoxious aquatic weed. We feel sure that our program, carried out by an autonomous taxing body, will be an effective approach to our problem, and that creation of this district marks an important step forward in local government weed control.

Hydrothol For Control Of Aquatic Weeds

By J. L. Frizzell

A number of fatty acid amine derivatives of Endothal acid have been evaluated for herbicidal activity for the last several years. These materials show an increased contact activity over Disodium Endothal. The composition of two of these materials selected for further field evaluation are as follows:

HYDROTHOL — di N. N dimethylcocoamine salt of Endothal.

Herbicide 191 — MONO N, N dimethylcocoamine salt of Endothal.

HYDROTHOL and Herbicide 191 are available as a liquid concentrate (soluble in water) and as a granular product. They are highly effective aquatic herbicides and algicides for use in irrigation and drainage canals, lakes, ponds and other problem areas to control the following weeds and algae:

Najas, Elodea, Coontail, Milfoil, Pondweeds, Water Stargrass, Cobamba, Cattail, Bur Reed, Algae and Chara.

In 1960 and 1961 extensive laboratory evaluations of HYDROTHOL were made. Still water tests indicated that this material was extremely active on Southern Naiad, Elodea and Coontail. Laboratory evaluations in 1961 indicated that the material required relatively short exposure time, which made it suitable for use in slow moving water.

A large experiment was initiated in the Spring of 1961, using HYDROTHOL at the rate of 3 ppm and 5 ppm in small farm canals. HYDROTHOL gave 100% control of Southern Naiad at both rates and little regrowth occurred at the end of nine months.

In June of 1961, HYDROTHOL was applied at 3 ppm and 5 ppm in a canal for the control of Southern Naiad and Coontail. HYDROTHOL was mixed with water and was applied from a boat with a gasoline-driven pump at a pressure of 60 psi. The solution was injected below the water surface. Again, good control was obtained.

In September of 1961, a drainage district field crew applied HYDROTHOL to farm canals one-mile long at the rate of 3 ppm. Complete control of Southern Naiad and Coontail was obtained within seventy-two hours after application of HYDROTHOL. In this same experiment, Herbicide 191 was applied to one-half mile of canal. Observations showed no difference in control obtained with the two chemicals. Numerous other field experiments have confirmed that there is no difference in performance of HYDROTHOL and Herbicide 191.

Extensive field tests for weed control and residue studies have been completed by the Missouri Conservation Commission. These tests were made to determine the herbicidal effectiveness and ecological aspects of the chemical treatment using HYDROTHOL. The field experiments for tracing the degradation of HYDROTHOL were performed in a farm pond located on the University of Missouri Ashland Wildlife Area. Seven enclosures, made by installing plastic curtains in this pond, were subjected to various dosage rates of the commercial formulation of HYDROTHOL. Applications of 0.1, 0.3, 0.6, 1.0, 3.0, 6.0, and 10.0 ppm by weight were made in the enclosures. Water and bottom fauna samples were collected prior to the introduction of the chemical. Water samples were taken daily from each of the enclosures and the control area for a period of twenty-seven days. Bottom fauna samples were collected three weeks following application. All samples were transported to the laboratory for analysis on the day they were collected. Analysis of these samples treated with HYDROTHOL showed that residues were found to be of short duration. Degradation studies of water residues indicated the rate of disappearance to be a function of time and concentration. The lower application rates of 0.1 to 3.0 ppm broke down rapidly within the first week, while higher concentrations of 6.0 to 10.0 ppm took up to twenty-five days. The analysis of fish flesh revealed negative absorption of HYDROTHOL at sub-lethal concentrations. Under field conditions, bottom dwelling fish food organisms increased in abundance and changed in species composition following treatment of vegetation. Bottom fauna showed some up-take of herbicide residues, but little or none was absorbed by fish.

Studies of the degradation of herbicide residues in water indicated that persistence is of short duration, with the rate of disappearance being a function of time and concentration.

In December of 1961, applications of water treated with HYDROTHOL at a rate of five and 10 ppm were made to growing tomato plants, onions, radishes, lettuce and peas. These tests were replicated twice with the soil being saturated to one-hundred percent with both 5 and 10 ppm. Analysis of the crops treated with 10 ppm showed a residue of 0.75 ppm and the 5 ppm showed a residue of 0.18 ppm. With the difference of .18 ppm and 0.75 ppm for 5 and 10 ppm, we certainly do not expect any residue when treated at 3 ppm.

There was no plant phytotoxcity at these high rates. Preliminary results indicate that treated water can be used safely for irrigation purposes without crop injury or residue of HYDROTHOL.

Animal toxicity studies are nearing completion at this time. So far, no ill effects have been detected.

Other uses of HYDROTHOL includes Algae control for ponds and lakes. Tests in 1960 and 1961 indicated that Cladophora and Pithophora can be controlled with dosages of 0.25 to 0.5 ppm acid equivalent applied both as a liquid or a granular.

Tests have shown that Algae in cooling towers, and other circulating systems, that an initial treatment of 3 ppm is sufficient under most conditions for control. Repeat treatments of 0.5 to 1.0 ppm at weekly intervals is suggested.

History Of Water Hyacinth Control In Louisiana

U. S. ARMY ENGINEER DISTRICT, NEW ORLEANS

It happened in New Orleans, Louisiana, in 1884. The water hyacinth (Eichornia Crassipes) was introduced for the first time in this country as a horticultural exhibit from the tropics. Its beauty and free-floating characteristics made it a great favorite with the public.

Since its growth was prolific, there was no hesitancy in giving sample plants to those who wished to beautify their ponds and to others who thought that the new plant might be an answer to some of their livestock feeding problems. And thus was born the problem which was to cause hardships to thousands and cost millions to control.

Within ten years after its introduction, the water hyacinth was a serious problem in some areas in Louisiana and was spreading elsewhere throughout the Gulf States. The first trouble spots in Louisiana were reported in the streams of St. Tammany Parish entering Lake Pontchartrain, in Bayou Plaquemine not far downstream from the old lock and in the Mermentau River in western Louisiana.

The water hyacinth problem had reached such proportions by 1898 that Congress was asked to assist and shortly thereafter the Corps of Engineers was given the mission of removing the water hyacinth from the navigable waterways of Louisiana whenever it became a hindrance to navigation.

An early survey disclosed the seriousness of the problem and

what appeared to be an adequate sum of money was recommended to destroy the plant at its source and prevent its further spread.

However, there were those who did not feel that these lavender flowered plants were the serious problem claimed and the funds made available were considerably less than those requested. Thus, the first chance and possibly the best to eradicate the menace was lost. A full realization of the extent of the infestation and the untold damage caused by these water plants was not forthcoming until many years later. By this time, the water hyacinth had spread throughout the southland.

In 1900, the Engineers put a crusher boat into operation in the initial move to control the pest growth clogging many of the main waterways of Louisiana. An elevating conveyor was mounted over the bow of a steamer and rollers similar to those in use in the sugar mills of the country were placed on the deck at the discharge end of the conveyor. The operation was slow, but it did kill hyacinths. The rate of advance of this first piece of plant did not permit great progress and this, coupled with the belief that the water hyacinth did not grow in the winter months and should be destroyed only in the summer, soon brought about a situation in which the destruction unit could barely keep abreast of the water hyacinth growth.

By 1902, a new chemical product had been introduced and was in use by the Engineers in their efforts to destroy the everspreading water hyacinth. Analysis of the new commercial product showed that it was sodium arsenite and from that point on it was manufactured on the spray boats from raw stocks of material. The use of this material continued until 1937 when it was abandoned in the interest of safety.

During the 35 years of its use, sodium arsenite proved to be excellent for destroying the water hyacinth and many improvements in its mixing and handling were made by the Engineers. Its application was affected through the use of high pressure steam driven pumps and suitable hose and spray nozzles. Complete kill of the water hyacinth and relatively open water was secured by the sodium arsenite treatment in about 21 days after the initial application of the poison.

Through all of these years the policy of working on a seasonal schedule was in effect and the struggle against the hyacinth was confined to the period between April and September. The work was confined to only the main channels of the waterways where navigation was involved and no effort was made to combat the pest growth at its source. Great numbers of hyacinths were destroyed each season, but by the next Spring the problem was as pressing as ever.

In the mid-thirties, a board of engineers made a study of the problem and recommended that mechanical means be developed to destroy the water hyacinth and a relatively new menace which had been identified as alligator-weed. This latter growth was not controlled by the sodium arsenite and continued to infiltrate into areas from which hyacinths had been removed.

The use of grapples mounted on barges had been tried, but this was too slow and costly to be considered as a satisfactory means of ridding the streams of the pest growths. Remembering the ease with which water hyacinths had been destroyed by the original crusher, it was decided to use that method again and the modern diesel-electric crusher boat KENNY was built and placed in use in 1937 from designs developed by the Engineers in New Orleans, La.

The KENNY was self-propelled and equipped with a 15-foot wide conveyor which could pick up a mat of vegetation at the rate of 100 feet per minute and deliver it to a set of corrugated steel rollers (much like an enormous fluting iron) operating under a pressure of 40,000 pounds, exerted by hydraulic rams. The crushed refuse was carried over the side by a high-speed conveyor to sink to the bottom and decay. The plant was effective in handling water hyacinths and proved to be excellent for destroying the alligatorweed. The KENNY remained in operation until 1951 and was responsible for the initial opening of many of the vegetation clogged streams in southern Louisiana.

The KENNY was a large item of plant and not suited for working in some of the tributaries and secondary waterways. By this time, the wisdom of working the year around and attacking the growth at its source in the feeder areas had become apparent. Floating conveyors were designed to work the lesser streams and contributed much to the overall results obtained.

These small conveyor units were placed in position against the stream bank and the vegetation in the waterway was cut away from its anchorage and drifted to the pick up end of the conveyor. At this point, men guided the vegetation to contact with the conveyor slats and started its movement upward and over onto the banks above the water line. It was left there to die from lack of moisture.

The single conveyors were moved from place to place along the streams leaving individual piles of water hyacinths. This was slow and multiple conveyors of the front pick up and side discharge type were developed to speed the work. These machines moved into the floating vegetation, picking up a mattress of water hyacinths 15 feet wide, and depositing the removed plants in a neat windrow along the bank through the utilization of a side discharge conveyor overhanging the bank. The ribbon of vegetation was cut to proper width at the point of pickup by mechanical rotating saws.

These conveyors were used with great success where it was possible to place the discharged mass of vegetation on the banks above normal water level. However, the rapid growth of trees along some of the waterways and the objections of land owners to piling the vegetation on their property led to the discontinuance of these units.

To replace the conveyor and to speed up clearing operations, destroyers of the multiple saw variety were developed to suit the needs in the waterways in Louisiana. Earlier models of this machine had been used in Florida with some good results, but these early models relied on the effects of the revolving saw banks to propel the unit. The advance became slow at times and, under certain conditions, forward movement was stopped. These difficulties were overcome in the Louisiana model of the saw boat and selfpropelled units capable of cutting a swath 20 to 40 feet wide were soon operating in the shallow bayous of the State. Smaller units were devised to work the tributaries and the total amount of water hyacinths destroyed increased accordingly. All of these machines were capable of moving forward at the rate of about one mile per hour into heavy infestations of floating water hyacinths. Destruction was immediate and even small boats could follow the path of the destroyer at once. The machines quickly picked up the nickname of "sea-going lawn mowers" and were a welcome sight to many boat operators who had previously struggled to move their craft through clogged streams in quest of their daily living.

These machines working in conjunction with the large crusher boat KENNY are credited with opening hundreds of miles of Louisiana waterways hitherto unusable.

But, machinery alone could not do a complete job. Many water hyacinths were left untouched in the shallow streams and in stump infested areas where floating plant could not operate. A search for some suitable chemical weed killer continued throughout the period of the mechanical method of destruction and many substances were tried by the Army Engineers under controlled conditions. None were found which appeared to be satisfactory or safe during this period of testing.

Then at the close of World War II, a growth control regulator became available. It was "2,4-D". This material produced the desired results as far as killing water hyacinths was concerned and it had the very decided advantage of being non-toxic to humans and animals in the amounts used. No fish kill was experienced except in some isolated areas where the decaying vegetation caused an oxygen deficiency in the water. The fish kill could be overcome by application patterns and caused no serious concern.

With the chemical at hand to destroy the fringes left by the mechanical units, great progress in overall control of the water hyacinth was made. Soon, many miles of hitherto infested streams were open to navigation again. As time passed and the work could be pushed back into the feeder areas, the water hyacinth began to be less of a threat to the movement of commerce and more of the water acreage became available for use by local interests.

Research was continued to determine whether a better material could be found for the destruction of the water hyacinth, but thus far the "2,4-D" method of control appears to be probably the best at hand.

New equipment was developed to improve the application of the chemical and research continues constantly to better the method and reduce the overall cost of maintaining the many thousands of miles of waterway in this State. The results are gratifying.

Utilizing a combined mechanical-chemical technique of attacking the water hyacinth, the U. S. Army Engineers have succeeded in opening all of the major navigable streams and

their principal tributaries in Louisana and are now placing many of them on an occasional maintenance basis. However, since the water hyacinth is a growing crop and spreads from seeds as well as vegetative shoots, constant work must be undertaken to hold the gains so far achieved.

The State of Louisiana, through its Wild Life and Fisheries Commission, became interested in water hyacinth destruction in the early 1940s. Its prime interest was to improve those waterways and inland lakes used by the sportsmen. This work was carried on independently although there was informal contact between the operating crews of the State and Engineers. In 1947, the State built a small elevating conveyor similar to those used by the Engineers and employed this machine to good advantage. However, the conveyor was eventually abandoned for the same reason that those used by the Engineers were taken out of service.

In 1948, the U. S. Army Engineers working in conjunction with the U. S. Department of Agriculture, the Department of the Interior, and the Public Health Service, submitted a report on existing conditions and made recommendations for future operations. As a result, Congress authorized a 5-year expanded aquatic weed control project in 1958 which enabled the State and U. S. Army Engineers to undertake a joint operation on a cost sharing basis. This joint venture has permitted an extensive, coordinated campaign against the water hyacinth throughout the entire State of Louisiana. Utilizing the larger and heavier equipment of the Engineers to open up avenues of approach and the lighter equipment of State for destroying the vegetation in the smaller tributaries, much progress has been made and at this time (1961) all major waterways and their principal feeder streams as well as many of the inland lakes in north Louisiana are now comparatively free of the pest growth.

The water hyacinth problem reached a peak in the late 1930s as a result of the widespread distribution of the plants during the great flood of 1927 and the completion of the Intracoastal Waterway in the early 30s, which served as a connecting link between infested areas and those hitherto free from the vegetation. Numerous new canals to serve oil well, etc., added to the problem and increased the mileage of streams requiring urgent attention. It was not uncommon during the early 1940s to learn that war traffic was being hindered in some places by the jams of water hyacinths.

However, as new equipment was developed to meet the emergency and new techniques were utilized for the destruction of the water hyacinth, progress was made towards the control of the pest growth in the waterways important to the war effort.

Using a well balanced mechanical and chemical attack on the water hyacinth based on a sound plan of operations has produced results which have completely changed the entire aspect of the overall picture. In the years since 1950, the combined efforts of all those engaged in aquatic vegetation control in Louisiana have succeeded in reducing the areas of infestation in the many usable streams to a point where the water hyacinth is no longer considered to be the serious menace that it was only a few short years ago.

The results of sixty years work in destroying the water hyacinth has resulted in opening some 3,000 miles of waterways and numerous inland lakes to those who use the waterways of Louisiana for sport or livelihood. The water hyacinth has been driven back to the dense swamps and to private grounds where access is impracticable at this time. All of the cleaned waterways are now on a maintenance schedule and the gains achieved in the past few years are held by these operations. Constant observation must be maintained on this pest growth for a few years. Neglect might well wipe out the excellent degree of control which is now evidenced.

The water hyacinth is a dangerous threat as long as some still grow in isolated waters, but it can be destroyed.

William E. Wunderlich
Chief, Aquatic Growth Control Section
New Orleans, Louisiana, October 25, 1961

Hyacinth-Obstruction To Navigation

JULY 1962

Charles F. Zeiger

Chief, Aquatic Plant Control Section, Operations Division
U. S. Army Engineer District, Jacksonville
Corps of Engineers, Jacksonville, Florida

Who? The Corps of Engineers.
Where? Florida.
What? Water Hyacinth.
Why? Obstruction to Navigation.
When? 1884 to Present.

Accounts vary as to the country of origin of this troublesome plant and many are the stories concerning the introduction of hyacinth into this country. A report dated 1898 stated that it is a native of tropical South America and was "introduced into this country many years ago." The first authentic account of its presence in the United States was at the New Orleans Cotton Exposition in 1884. The plant is eye-catching, beautiful and tempting. Some nameless Floridan found it so attractive that he procured some of the plants to place in a lawn fountain at his home on the banks of the St. Johns River somewhere close to Palatka, Florida. Of course, the plant multiplied rapidly and the excess was thrown into the nearby river. By 1896 the plant had spread at an alarming rate and was seen throughout most of the St. Johns River Basin. By 1900, hyacinth had taken over the river at Palatka to such extent that it became a curse to navigation in that steamboats and other craft were unable to reach docks or pass through navigation openings of bridges. Since then it has spread in Florida from as far north as the Suwannee River to as far south as Florida's famous Everglades.

In favorable environment where the plants are seldom killed by frost, hyacinth attain a height of 50 inches and a density of 200,000 plants per acre. In more northerly areas where the growth is checked by low winter temperatures, the plants quite naturally are smaller and reach a density of 450,000 or more per acre.

All hyacinth flower produce seeds, but under normal conditions only about 5 per cent of the seeds germinate. These seed capsules are three-celled and each bears from 3 to 250 tiny seeds. Therefore, a stand of medium-sized plants can produce as high as 45 million seeds per acre. However, the principle method of reproduction is by stolons which grow laterly below the water surface from the rhizomes at the center of the plant. When these attain a length of some 6 inches, a new plant forms, which in turn, sends out stolons to form other new plants. In this manner, plants can double in number within 10 days. Under ideal conditions, 10 plants can cover an entire acre in 10 months.

The Corps of Engineers became concerned about hyacinth obstructing the navigable waters of the south as early as 1897. Below is a quote from the Annual Report of the Chief of Engineers for 1900:

"Removing the water hyacinth from Florida Waters.—Under the provisions of the sundry civil act approved June 4, 1897, a Board of Engineer Officers was appointed to investigate the extent of the obstruction of the navigable streams of Florida, Louisiana, and other South Atlantic and Gulf States, by the aquatic plant known as the water hyacinth, and to perform such experimental work as might be deemed necessary to determine a feasible plan or method of checking or removing such obstructions.

"The report of this Board, dated November 30, 1898, is printed in House Doc. No. 91, Fifty-fifth Congress, third session, and on page 1615 of the Annual Report of the Chief of Engineers for 1899. In Florida the Board found that the main channel of the Upper St. Johns River was affected by the plant, while many of the smaller channels were completely blocked. The Board recommended the construction of a steamer fitted with crushing machinery, and the use of log booms as adjuncts to the operation of the boat.

"The river and harbor act approved March 3, 1899, appropriated $25,000 for the construction of a boat, $1,000 for log booms, and $10,000 for operating expenses. Under this provision it is proposed to design a suitable boat and have same built by contract. Some work has been done on plans, but the matter has been deferred pending results of a test of the boat procured for the Louisiana district.

"During the winter of 1899-1900 the tops of the plants in the St. Johns River were destroyed by a frost which has retarded their interference with navigation. Recent reports indicate that the plant is becoming troublesome in the Withlacoochee River on the Gulf coast."

Hyacinths are also obstructive to aircraft. During World War II large scale seaplane operations were conducted in the St. Johns River at the Jacksonville Naval Air Station. It was found that hyacinth even in small concentration were a serious