Aquatic Weed Control In The Sub-Drainage Districts Of The Florida Everglades

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In view of present development it is difficult to visualize the Everglades as conditions existed before reclamation was undertaken. Prior to drainage and reclamation the vast Kissimmee watershed together with that of Fisheating Creek flowing into Lake Okeechobee overflowed the south rim of the Lake and inundated the Everglades to the south and east.

When Florida was acquired by the United States in 1821 the inner Everglades was a land of mystery to the white man and remained so until the period of the Seminole Indian War of 1835-1842. This war brought the attention of the people of the territory of Florida upon the Everglades region constituting one of the largest bodies of peat lands in the world and gave impetus to later plans for its development.

The drainage of the vast Everglades area south and east of Lake Okeechobee was made possible by the Swamp Land Act of 1850, wherein Federal lands were granted to the States for reclamation purposes. However no date was fixed for the beginning of drainage, an omission which Florida did nothing to change. Actual patent for much of the Federal Grant was not completed until 1903. The Everglades and other public lands under the Swamp Land Act were entrusted by the State of Florida in 1855 to a new agency, the Trustees of the Internal Improvement Fund, the membership of which consisted of the Governor, Comptroller, Treasurer, Attorney General and Registrar of State lands. The last-named officer was later replaced by the Commissioner of Agriculture. Little was accomplished by the early I. I. F. Boards towards drainage of the Everglades. In fact much harm was done as reported by Historian Dr. A. J. Hanna(1) wherein he quoted D. Graham Copeland in his 1930 report to the Board of Commissioners of the Everglades Drainage District. "Bankrupt, broken in spirit, downtrodden, Florida in 1879 grabbed the only available means of support—the swamp and overflowed lands — and handed them over in lavish fashion to railroad companies, which, generally speaking, exacted an usurious rate of interest for the help they rendered in putting the northern and western portions of the State back on their feet."

Desultory, random attempts at reclamation and drainage of parts of this area were attempted during the period following the Seminole Indian War, the most note worthy being that of Hamilton Diston, beginning in 1881 which was the first major attempt toward drainage of the Everglades. The total results of the Diston attempt, which ended in failure in 1889, were the digging of the Three-Mile Canal connecting Lake Okeechobee with Caloosahatchee River, and another canal extending southward from Lake Okeechobee and discharging upon the ground surface in the Glades.

The next decade was notable for the lack of progress until Governor Napoleon B. Broward pushed through by strength of his will power, against heavy oposition from railroad interests, newspapers and north Florida citizens, the drainage law of 1907 forming the Everglades Drainage District. By 1910 a start had been made with engineering work underway, contracts let and dredges put to work. The effect of this program was reflected in an increase in the number of Everglades land owners from about a dozen in 1909 to 15,000 in 1911. The price of State lands advanced from $2.00 per acre in 1919 to $15.00 in 1910.

SUB-DRAINAGE DISTRICTS

The Everglades Drainage District and its successor Central and Southern Florida Flood Control District has undertaken only to provide main outlet drains for included lands.

Sub-Drainage District, of which we are principally concerned in this report, wholly or partly within the Everglades Drainage District were authorized by act of June 7, 1919 (ch 7866). Other local drainage districts have been formed under the State General Drainage laws. These sub-drainage districts have been organized, pumping plants, canals and lateral systems constructed to obtain additional drainage, flood protection and irrigation.

Sub-drainage Districts with which the writers are involved are Pelican Lake Sub-Drainage District, Pahokee Drainage District, East Beach Water Control District, East Shore Drainage District, South Florida Conservancy District, South

Shore Drainage District, Ritta Drainage District, Sugarland Drainage District, Clewiston Drainage District and Diston Island Drainage District all combined containing a total of 236 square miles or an area of 151,000 acres extending along the eastern and southern shore and adjacent to Lake Okeechobee (Table 1); Pelican Lake Drainage District located in the Canal Point area was the first of these to organize, this being in 1913. It was followed within a very few years by all the others with the exception of East Shore Drainage District and Ritta Drainage District which were organized in the early 1940's. A major portion of the area encompassed by these districts is peat soils generally excellent in quality fully developed and highly productive.

Table 1. The 10 sub-drainage Districts and the encompassing area of each District as established along the Eastern and Southern shores of Lake Okeechobee.

District	Area sq. miles
1. Pelican Lake Sub-Drainage District	14
2. Pahokee Drainage District	22
3. East Beach Water Control District	10
4. East Shore Drainage District	13
5. South Florlda Conservancy District	51
6. South Shore Drainage District	07
7. Ritta Drainage District	15
8. Sugarland Drainage District	67
9. Clewiston Drainage District	06
10. Diston Island Drainage District	31
Total	236

Ground surfaces throughout the districts for all practical purposes is flat, lying at elevations of 13 feet to 15 feet above mean sea level. Because of the flatness of terrain movement of water in the canal and lateral systems of each district must be accomplished by pumping. The canal and lateral system of all these districts follow the same general design of a main pump canal located near the center of the district with lateral ditches spaced at one half mile intervals, usually of one mile to one and one half mile in length and feeding into the main canal. The lands in each district are protected from outside flood waters by a levee along its outside boundaries and drainage water from district lands is accumulatively collected in the main canal and delivered to the pumping plant which discharges either into Lake Okeechobee or an arterial canal of Central and Southern Florida Flood Control District.

A typical drainage district layout is presented in Figure 1, showing East Shore Drainage District covering 13 square miles with 36 linear miles of laterals and canals.

WATER HYACINTH (Eichhornia crassipes)

Most authorities agree that the water hyacinth entered the south eastern states at the Cotton States Exposition held in New Orleans in 1884 and was brought to the St. Johns River area of Florida in that year.

The method and time required for this aquatic pest to travel down the center of Florida for a distance of 200 or more miles is not known. A photograph reputed to have been taken in 1915 of Taylor's Creek, Okeechobee City clearly shows a growth of Hyacinth.

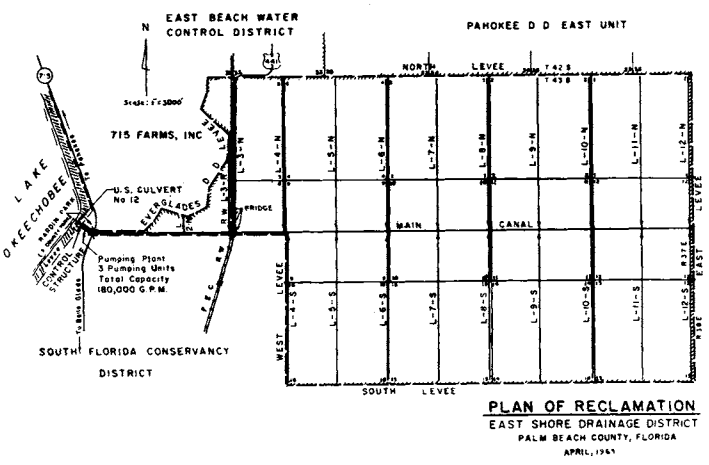

Figure 1. Typical drainage district.

Lawrence E. Will(5) in his book recalling the early days on the Lake, tells this story of the arrival of the water hyacinth. "It must have been about in 1897 or '98 that Eli Morgan, a cattleman of Bassenger who later moved to Bluefields decided to raise some cheap cow feed. He hired Bill Whidden, with his horse and wagon, to get some plants from the St. Johns and sow them in ponds and other ditches around Bassenger. From there eventually they got into every stream, every pond, and every canal in South Florida."

Whether the Hyacinth was brought by man, according to Will, or by natural means is of little importance, but by the second decade of this century this pest was able to choke to death the once thriving steam boat trade on Lake Okeechobee. From its establishment until 1945, multiplying and growing almost unchecked the growth of Hyacinths became so great that it was possible to walk across many of the main drainage canals. Draglines equipped with special Hyacinth buckets were the only control methods available. These were slow and expensive and were able to clean ¼ mile of lateral per day. Even on an around the clock basis they were unable to stay ahead of the prolific reproduction of the water hyacinth. Many variations of the same idea were attempted, essentially they were all similar, the mechanical removal of the plants from the water to the bank or shore. Invariably a few were always left to commence their prolific reproductive cycle. These plants growing under favorable conditions are able to reproduce at an astounding rate. W. T. Penfound and T. T. Earle(3) in a study of water hyacinths in Louisiana reported in 1948, that these plants will grow outward about the periphery of the mat at the rate of 2 feet per month, the plants doubling their numbers every 2 weeks.

The weed killing properties of the growth hormone 2,4-D were recognized in 1941 and within a few short years this compound was used and mis-used on almost every conceivable weed situation. By 1946 the chemical control with 2,4-D of water hyacinth came into general use in the several sub-drainage districts of the Everglades, the 60 year reign of this pest seemed to be at an end. However, sixteen years later in July 19, 1961 a group of men banded together to form The Hyacinth Control Society whose stated purpose; "Shall be to assist in promoting control of water hyacinths and other noxious aquatic weeds." As members of this society we are well aware of the fact that while we have some control of this plant pest, it will probably never be eradicated from this area.

OTHER AQUATIC PLANTS

As the main canals, laterals and field ditches become open and clear of the heretofore solid cover, the ecology of the aquatic growth changed. Now the submersed weeds received the needed sun light and oxygen and became in many areas more of a problem than the water hyacinth. These submersed weeds include, common coontail (*Cerotophyllum demersum*), southern naiad (*Najas guadalupensis*), bladderwort (*Utricularia* spp.), elodea (*Elodea densa*) and many other species to a lessor degree.

In many respects the submersed aquatics are a greater pest than the water hyacinth as during periods of heavy rainfall they effectively reduce the flow of water to the drainage pumps and the disloged plants choke the Wood's screw type pumps. Since most drainage canals have ideal growth conditions for submersed weeds, i.e., a maximum depth of less than 10 feet, clear non-turbid water and adequate nutrients leached from surrounding fields; this group of aquatic weeds have given most drainage districts an expensive control problem. One unique method and it would appear simple solution to this problem would be to again shade the bottom. The officials of one drainage district have attempted to do this by encouraging the growth of duckweed. This was done by trucking large quantities from heavy growth areas to be planted in problem canals. It was felt that this floating aquatic weed would provide the necessary shade to suppress the submerged growth while having the advantage, due to their size and growth habits, pass through the large capacity Wood's screw pumps. This is largely true and it has been observed that the plants are not found close to pump stations but have become established in some more distant areas.

CHEMICAL CONTROL

Most of the sub-drainage districts do not conduct their own formal research projects but follow the suggestions of the State and Federal research facilities. Therefore the control methods are more or less uniform. Use of the following chemical herbicides has become routine.

2,4-D (2,4-diclorophenoxyacetic acid). There is no doubt that a greater quantity of 2,4-D is used than any other herbicide both on aquatic weeds and canal bank maintenance. While most authors of papers such as this, report that 2,4-D is applied at rates of 2 to 4 lbs. active acid per acre to control water hyacinth and weeds growing adjacent to the canals. In actual field practice most spraying is done in a spot spraying situations and the workman has slight knowledge or control of the rate sprayed. Usually the number of gallons of 2,4-D concentrate, most frequently the amine salt formulation, is added to a fixed number of gallons of water, the resulting solution is applied on a spray to wet basis. Surfactants are either incorporated into the base solution or added to the dilute mixture.

2,4,5-T (2,4,5-trichlorophenoxyacetic acid). This material is used primarily on the control of ditch bank maintenance for the control of elderberry, castorbean and other such woody plants which might grow on the canal banks and interfere with routine maintenance of right-of-way.

DOWPON (2,2-dichloropropionic acid). Dowpon has found wide usage for the control of ditch bank grasses and emersed aquatics. It is particularly useful on the control of paragrass, which is land rooted but becomes an aquatic by sending out long stems, capable of choking a narrow drainage ditch. It is also effective when used as a folige spray on emersed aquatics, e.g., maidencane, cattails and cutgrass but not broad-leaved plants. Repeat application gives the most effective results with grass species rooted in standing water. This chemical is almost harmless to fish when applied at the usual rates. A poll of the several District supervisors shows that Dowpon is applied at the rate of 15 lbs. per 100-150 gal. and spray to wet.

SILVEX [2-(2,4,5-trichlorophenoxy)propionic acid]. Silvex is a phenoxy compound related to 2,4-D and 2,4,5-T. Some small amounts of Silvex are applied to control Alligator weed (*Alternanthera philoxeroides*).

EMULSIFIABLE SOLVENTS. The use of emulsifiable solvent was recommended by J. C. Stephens *et al*(4) in 1947 and have been used by the Drainage Districts on a very limited scale, to control submersed aquatics. Essentially the formulation of this material is the modification of the specific gravity of gasoline or some other unsaturated hydrocarbon with enough chlorinated benzenes dispensed in them to make the dispension slightly denser than water, these are combined with 2½% non-ionic type emulsifiers. Under proper conditions the emulsifiable solvents give good control of the three main submersed aquatic weeds, southern naiad, coontail and bladderwort. The main deterrent to the use of this herbicide is the danger of fire and the material will kill all aquatic life, including fish, crayfish and snails.

AQUALIN, (acrolein - acrylic aldehyde). This chemical was developed for aquatic weed control by The Shell Chemical Corporation and its use reported to this Society by Hussey(2) in 1962.

Aqualin herbicide appears to be toxic to all submersed weeds and in our experience has given good long term control of this group of aquatics. The major disadvantage to the use of Aqualin involves the use of a highly toxic material, the handling of which requires technically trained personnel. Further, it is a highly reactive chemical and readily forms polymers. In a drum or closed system, Aqualin herbicide can polymerize with sufficient violence to rupture the drum. The manufacturer has attempted to overcome this danger by change in the container.

METHODS OF APPLICATION

The various spray rigs and other application devices used by the ten drainage districts are as varied as the imagination and ingenuity of man can divise. Due to the ready access to canals and laterals most spray rigs are wheeled devices either self-propelled or tractor pulled. Most districts also have floating spray equipment usually a small row boat to gain access to canals inaccessible by canal side roads.

The majority of the spray application is done with the familiar hand held gun, however, spray booms are some times used for ditch bank maintenance where there are long open areas in which the control problem are broad leaved weeds to be controlled by 2,4-D.

CONCLUSION

Chemical weed control is still in its infancy. However, remarkable progress has been made in developing herbicidal uses for drainage facility maintenance. The use of herbicides

has made a considerable contribution in alleviating some of the financial problems of the various sub-drainage districts. Generally speaking revenue from per acre assessments have failed to keep up with ever increasing maintenance costs.

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