Development Of The Bottom Placement Technique For Hydrilla And Eelgrass Control

W. L. McCLINTOCK and J. W. FRYE

Superintendent and Assistant Superintendent
Environmental Division — Lake Section
City of Winter Park
Winter Park, Florida 32789
and

WILLIAM D. HOGAN

Regional Technical Specialist
Chevron Chemical Company
Orlando, Florida 32804

INTRODUCTION

In 1968 many of the 14 lakes, especially Lake Virginia, within the City of Winter Park, Florida were densely infested with hydrilla (*Hydrilla verticillata* Royle) and eelgrass (*Vallisneria americana* Michx.). This heavy growth occurred from the shallow water at the beach out to a depth of 20 ft.

Manual methods of removing the weed growth were used by many of our lake front homeowners with results that were, in general, very unsatisfactory. In October 1963 the City of Winter Park purchased an aquatic weed harvester and barge for approximately $22,000 to mechanically remove the top 5 ft of the weed mass (1). In 1967, 1,585 tons of aquatic weeds were mowed and removed at an average cost of $10.35 per ton. This amounted to $16,404.70 with an additional expense of approximately $16,000 for maintenance of the equipment. This harvester proved inadequate to control the weed problem, so a second and third harvester units were purchased in 1968 for $39,000 each.

Continuous difficulties in disposing of the harvested weeds and the constantly rising operation and maintenance costs coupled with only marginal weed control at best, emphasized the need for a more effective control system. This situation led to our investigating several chemical weed control systems in 1969. This investigation is continuing even now, as newer herbicides become available. Out of this intensive program, the Bottom Placement Technique was developed whereby a herbicide or combination of herbicides could be placed near the bottom of a lake with equipment especially designed for this purpose.

DESIGN OF EQUIPMENT

A polyvinylchloride (PVC) boom was designed in 1969 for use on two motorized barges equipped with trailing hoses spaced 35 inches apart. This boom is 20 ft long and has a 2-inch inside diameter with a main manifold brass intake valve positioned in the center. The boom is supported by a 3-inch aluminum channel beam.

The 20-ft drop hoses are made of double braided air hose having a 0.5-inch inside diameter. They attach to a nipple extending downward from the "T"s on the boom with a 1-inch inside diameter. The upper 12 inches of the trailing hose is protected with a neoprene sheet to prevent kinkage and twisting. The lower ends of the applicator hoses are weighted with brass nipples and capped. The cap is center-drilled with a 0.16-inch orifice. This weight factor of 6.5 lb when added to the forward speed of the barge moving on the surface at 2 mph caused the hoses to trail at approximately 12 inches from the lake bottom.

APPLICATION OF HERBICIDES

Herbicides used in the Bottom Placement Technique are presented in Table 1. These herbicides were mixed in a tank prior to application in sufficient amounts so that 2 gal of diquat plus either 20 lb of copper sulfate or 4 gal of one of the copper complex chemicals diluted in 100 gal of water were applied per surface acre.

Tests were conducted in October 1972 using the Bottom Placement Technique with various combinations of diquat plus a copper source on plots 1 acre in size. The plants were evaluated visually for phytotoxic effects of the herbicides. Water samples were collected at a depth of 4 ft below the lake surface using a Pole Water Tube which collected 1.0 gal. Samples were stabilized with con-

TABLE 1. HERBICIDES USED IN THE BOTTOM PLACEMENT TECHNIQUE FOR THE CONTROL OF HYDRILLA.

Chemical name	Common or trade name	Active ingredient
6,7-dihydrodipyrido(1,2-a:2',1'-c) pyrazidiinium (as dibromide salt)[a]	Diquat	2 lb cation/gal
Copper sulfate pentahydrate	Copper sulfate	53%
Copper triethanolamine complex	Cutrine	0.76 lb/gal
Copper hydroxide triethanolamine compound	K-lox	0.8 lb/gal

[a]Granted an interim tolerance of 0.01 ppm in potable water by the Environmental Protection Agency in Washington, D.C., on November 15, 1972.

Table 2. Hydrilla and Eelgrass Control With The Bottom Placement Technique.

Plot location	Herbicide (concentration/surface acre)	Control rating[a] Days after treatment 0	1	7	14	21	28
Lake Maitland #1	2 gal diquat + 20 lb $CuSO_4$	0	2	4	6	8	10
Lake Maitland #2	2 gal diquat + 4 gal K-lox	0	2.5	4	6.5	8.5	10
Lake Osceola	2 gal diquat + 4 gal Cutrine	0	2	4.5	6.5	8.75	10
Untreated check Lake Maitland	— —	0	0	0	0	0	0

[a]0=no control with mass of weeds extending to surface. 2=slightly wilted, but with no visible foliage color change. 4=general browning of foliage and slight drop of mass 6 to 8 inches below the surface. 6=initial defoliation of hydrilla and general drop of weed mass 1 to 3 ft below the surface. 8=stems of hydrilla bare and eelgrass collapsing with a general drop of weed mass 3 to 4 ft below the surface. 10=weed mass 5 ft below surface and rapidly decaying on lake bottom.

centrated sulfuric acid at a rate of 3.37 fluid oz per gal of water. These samples were then analyzed for diquat residue by the Pattison's Laboratories, Harlingen, Texas.

RESULTS AND DISCUSSION

Combinations of diquat plus the various copper sources resulted in good control of hydrilla and eelgrass within 10 days after application of these herbicides (Table 2). The weed mass was 5 ft below the surface and rapidly decaying on the lake bottom 28 days after application of the chemical.

As shown in Table 3, residual levels of diquat 4 ft below the surface were below the interim tolerance of 0.01 ppm except for samples collected 1 day after treatment with diquat plus K-lox and for the 30-minute and 1-day samples in the diquat plus Cutrine treated areas. Diquat levels dissipated rapidly after these treatments.

The Bottom Placement Technique provides the City of Winter Park with a significant cost savings in herbicide expense when compared with the currently acceptable ppm technique for applying diquat at $25.85 per gal is $51.70 per surface acre as compared with 14.0 gal at a cost of $361.19 to treat an acre of water which averages 10 ft in depth.

The Bottom Placement Technique provides a significant reduction in the amount of herbicide applied per surface acre, i.e., a reduction from 14 gal in this illustration to 2 gal. Even considering that the Bottom Placement Technique may be used twice each year on a 6-month interval, the reduction in cost and the amount of herbicide applied is still significant.

Even though very little use is made of the lakes of Winter Park as a potable water supply, we were pleased to find the low levels of residual diquat ranging from 0.0005 ppm to 0.0026 ppm 7 days after treatment. Diquat in combination with a satisfactory copper ion source can be used safely in the City of Winter Park's 1,019 acres of surface lake water and along more than 20 miles of shoreline for the control of hydrilla and eelgrass with the Bottom Placement Technique.

LITERATURE CITED

1. Blanchard, Jay L., 1967. Economic aspects of weed control in the lakes of Winter Park, Florida. Hyacinth Contr. J. 6:21-22.

Table 3. Residual Levels of Diquat 4 Ft Below The Surface After Use of The Bottom Placement Technique.

Plot location	Herbicide (concentration/surface acre)	Hours after treatment	Diquat (ppm)
Lake Maitland #1	2 gal diquat + 20 lb $CuSO_4$	0.0	0.0008
		0.5	0.0090
		24.0	0.0093
		72.0	0.0027
		168.0	0.0005
Lake Maitland #2	2 gal diquat + 4 gal K-lox	0.0	0.0011
		0.5	0.0079
		24.0	0.0120
		72.0	0.0042
		168.0	0.0026
Lake Osceola	2 gal diquat + 4 gal Cutrine	0.0	0.0016
		0.5	0.0140
		24.0	0.0132
		72.0	0.0051
		168.0	0.0013