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Evaluation Of Metham For Control Of Hydrilla Regrowth From Tubers[1]

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INTRODUCTION

Hydrilla (*Hydrilla verticillata* (L.F.) Royle) is a submersed aquatic plant that causes serious problems in freshwaters in the southeastern United States. Reproduction occurs vegetatively by formation of turions that abscise and ultimately form new plants. New shoots are also produced from tubers and rootstocks in the hydrosoil and from fragments of the parent shoot (1, 5). Because hydrilla is dioecious and only the female plant is known to grow in the United States, sexual reproduction is not known to occur here. However, vegetative proliferation is extremely rapid and large bodies of water have become completely infested within 2 to 3 years. Hydrilla was first found in the United States in Crystal River, Florida around 1958 and in Miami around 1960, apparently introduced from Singapore or Madagascar through the aquarium trade (1). It has been sold throughout the United States as an aquarium plant and has been transported from infested sites to other rivers, lakes and canals. As a result it is now found in Florida, Georgia, Alabama, Mississippi, Louisiana, Texas, California and possibly Colorado and Wisconsin.

In the fall of 1976 hydrilla was reported in 13 ha Ellis Lake at Marysville, California. Subsequent surveys identified several other infestations. The hydrilla infestation in Ellis Lake poses a threat to the rice-growing areas of the Sacramento Valley and, because of the lake's proximity to the Yuba and Feather Rivers, hydrilla could easily spread throughout these river systems. A cooperative hydrilla eradication program was undertaken between the California Department of Food and Agriculture, the Yuba County Agricultural Commission, the city of Marysville and USDA, SEA, AR, at the University of California, Davis. The plans for eradication involve the draining of the lake, removal of the hydrosoil and tubers to a safe site and then treatment of the lake bottom to kill any remaining tubers. Because the soil fumigant metham (sodium methyldithiocarbamate, 32.7% a.i.) successfully eradicated aquatic weeds in an earlier program (2, 3, 4) it was recommended for use in a feasibility study. A series of tests was then undertaken to determine the effectiveness of metham for control of hydrilla regrowth from tubers.

[1]Cooperative investigation of the U. S. Department of Agriculture, Science and Education Administration, Agricultural Research, University of Florida, Agricultural Research Center, Fort Lauderdale and Bureau of Aquatic Plant Research and Control, Florida Department of Natural Resources, Tallahassee, Florida.

METHODS

Ten hydrilla tubers were planted 10 cm deep in 25 cm diam plastic pots containing 6.4 liters of water-saturated, sand-muck potting soil. Duplicate treatments of metham were applied to the pots at rates of 187, 374 and 935 liter per ha on March 9, 1977. To simulate field conditions, treatments were applied to the surface or injected 5 cm below the surface of soil previously drained to field capacity moisture levels, or were applied to the surface of saturated (undrained) soils. After treatment, the pots containing soil at field capacity moisture levels were flooded until leachate was observed emerging from bottom drainage holes. This was to simulate reflooding and leaching of metham to lower soil depths. The treated pots, along with the controls, were then submersed to 40 cm in 77 cm wide by 219 cm long concrete aquaria outdoors. The growth responses of the tubers to the various treatments were observed periodically and recorded. One set of duplicate treatments was harvested on April 27, 1977 and one on June 13, 1977, 7 and 14 weeks after tubers were planted and treated. The soil from harvested pots was washed through a 1-mm screen and the condition of the collected propagules was determined. Unsprouted tubers were transferred to water in 3.8 l jars and observed for 7 weeks for sprouting.

A second test was conducted to determine the effects on regrowth of hydrilla from sprouting tubers when metham was applied as a total volume treatment to the water. Five hydrilla tubers were planted in soil in each of two 5 cm pots that were then placed in jars in 3.8 l of water in the laboratory. Metham was applied to the water at rates of 0.1, 0.2, 0.4 and 1.0 mg per liter. The number and condition of the sprouted and unsprouted tubers was observed at intervals of 3, 5, 7 and 14 days after treatment.

RESULTS AND DISCUSSION

The most effective treatment in terms of inhibition of growth from tubers apparently was subsoil injection of metham followed by leaching (Table 1). The number of unsprouted tubers and decomposed tubers was greatest with this treatment and most unsprouted tubers were decomposed by 7 weeks after treatment. The number of unsprouted tubers increased as the treatment rate increased, and 935 liter per ha was the most effective rate.

The second most effective treatment was surface application of metham followed by leaching. The number of

TABLE 1. EFFECTS OF METHAM TREATMENTS ON VIABILITY OF HYDRILLA TUBERS 7 AND 14 WEEKS AFTER TREATMENT.

Metham Treatment	7 weeks			14 weeks		
	Plants	Sprouted tubers	Unsprouted tubers	Plants	Sprouted tubers	Unsprouted tubers
374[1]	1	5	4	0	0	10
935	0	6	4	0	0	10
187[2]	0	2	8	0	1	9
374	0	1	9	0	0	10
935	0	0	10	0	0	10
374[3]	5	3	2	6	2	2
935	1	5	4	4	4	2
Control	1	6	3	4	2	4

[1] Chemical applied to surface of drained soil and then leached by flooding.
[2] Chemical injected below surface of drained soil and then leached by flooding.
[3] Chemical applied to surface of saturated soil, not leached.

sprouted tubers at the first observation (7 wks) was 50 and 60%. However, the number at the second harvest (14 wks) was zero indicating that the tubers that might have sprouted earlier had absorbed lethal doses of metham from surrounding soil. The most effective rate with this technique was 935 liters of metham per ha. One plant was produced following the treatment at 374 liters per ha (7 wks). The least effective technique was application of metham to saturated soil followed by immediate immersion. Growth of hydrilla did not differ between this treatment technique and the controls.

A total of 16 new tubers was produced during these experiments; three at seven weeks and 13 at 14 weeks after treatment. Overall, seven tubers were produced in the control pots and nine were produced in the pots treated with metham on the surface of undrained soils.

The effects of total volume treatments on germination of tubers were evaluated with laboratory bioassays. These treatments were not effective because the germination of treated tubers did not differ from that of the controls. Germination ranged from 90 to 100% after two weeks. Although metham is relatively stable in concentrated aqueous solution, it is less stable in dilute solutions and decomposes readily to volatile methylisothiocyanate, which provides the fumigating activity. Apparently metham must be incorporated into soil to reduce losses through volatilization from water and extend the period of maximum effectiveness. On land the manufacturers recommend that treated areas be covered with tarps or plastic sheets to prolong activity.

SUMMARY

In summary, the most effective procedure for application of metham to inhibit germination of hydrilla tubers was subsurface injection into moist soil followed immediately by flooding to leach the chemical to greater soil depths. Incorporation and leaching of the chemical to lower soil depths reduces loss through volatilization, extends the period of activity of the compound, and enables lethal doses to be absorbed by tubers and other propagules. Our results indicated that this procedure may be an effective control technique but should be tested further under field conditions.

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LITERATURE CITED

1. Blackburn, R. D., L. W. Weldon, R. R. Yeo and T. M. Taylor. 1969. Identification and distribution of certain similar-appearing submersed aquatic weeds in Florida. Hyac. Cont. J. 8:17-21.
2. Clark, W. R. 1973. Alligatorweed eradication program saves California waterways. Weeds, Trees and Turf. 12(5):15, 53, 55.
3. Clark, W. R. 1969. Controlling alligatorweed in Tulare County. Proc. 21st Calif. Weed Conf. 43-46.
4. Prior, M. R. 1969. Alligatorweed control with Vapam (SMDC). Res. Prog. Rep. West. Soc. Weed Sci. 101-102.
5. Steward, K. K. 1969. Effects of growth regulators and herbicides on germination of hydrilla turions. Weed Sci. 17:299-301.