Control of Fragrant Waterlily (*Nymphaea odorata*)[1]

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ABSTRACT

Evaluations made during a 4-year period have shown that 2,6-dichlorobenzonitrile (dichlobenil) granules applied at 4 to 10 lb/A control fragrant waterlily (*Nymphaea odorata* Ait.). Dichlobenil appeared more effective when applied during the active growing season. A combination of granular forms of dichlobenil and (2,4-dichlorophenoxy) acetic acid (2,4-D) applied at 4 plus 4 lb/A resulted in no better control than when dichlobenil was applied alone. Dichlobenil applied after the development of fragrant waterlily root stolons caused the surfacing of stolons approximately 8 weeks after treatment. Residues of dichlobenil could not be detected in the water after treatment nor in the hydrosoil 8 weeks following treatment. Dichlobenil residue could not be detected in water or hydrosoil outside of the treated area in non-flowing water.

INTRODUCTION

Fragrant waterlily is found throughout the Eastern United States. This aquatic plant is distinctive for its sweetscented, white, showy flower. The leaves of this plant are split to a petiole attached at the center and lie mostly flat on the surface. They are green on top, often purplish on the bottom, and are usually 0.6 to 12 inches across (6). Ornamental plantings of fragrant waterlily in small ponds have initiated dense infestations that have spread to many shallow water lakes. The extensive growth interfere with boating and fishing and contribute to siltation (4).

Phenoxy herbicides applied to control many large infestations of fragrant waterlily have been very unsatisfactory. Removing the plant by mechanical means is expensive and control is of short duration. Dichlobenil has been reported to be effective on *Chara* sp. (3), submersed aquatic plants (1, 2) and several species of waterlilies (2, 5).

The objectivites of the study were to determine the best rates and seasons of the year for applying dichlobenil as a control of fragrant waterlily, and the longevity of residues in soil and water.

MATERIALS AND METHODS

Field Experiments. Several experiments were initiated on fragrant waterlily between 1967 and 1969 to evaluate the effectiveness of dichlobenil. These experiments were conducted in impounded areas in Georgia and South Carolina. Dichlobenil and a combination of dichlobenil plus 2,4-D was applied to 50 by 50 ft plots with 50 ft buffer zones in 1967 and 1968. In 1969, the plot size was increased to 100 by 100 ft with 100 ft buffer zones. The buffer zones were used to eliminate contamination between plots.

The granular herbicides were applied on the plots using a hand operated centrifugal spreader. Extreme care was taken to insure uniform distribution of the granules in each plot. The rates of dichlobenil applied varied from 4 to 10 lb/A. The combination treatment was applied at 4 lb/A of each herbicide.

The experimental design for all experiments was a randomized block with three replications. Control was based on the percent difference in leaf cover of treated and untreated areas. A control rating of 100% was given to plots that were completely free of leaves and stems. No attempt was made to remove rootstocks from the hydrosoil.

Residue Study. Water samples were taken at 0, 1, 2, 4, 8, 16, 32, and 74 days after treatment. Samples were taken from the treated plots and outside of the plots and in the direction of water flow at intervals of 50, 100, and 200 ft. Each sample was a composite of three sub-samples. In order to prevent sampling in the same area twice, the subsample areas were marked with a wire approximately 48 inches long, with the top formed in a circle.

Water samples were taken by submerging a quart jar beneath the surface approximately 12 inches. The lid was removed after the jar was submerged to prevent surface organic debri from contaminating the water sample. After filling the jar, the lid was replaced and the sample retrieved. A composite was made from the three sub-samples by mixing them in a bucket. The jar containing the composite samples was labeled and transported to the laboratory. Dichlobenil was extracted from the water with redistilled benzene and shipped to the Thompson-Hayward Chemical Company for residue analysis.

Hydrosoil samples were obtained using a 2 inch diameter pipe 4 ft long with a detachable 8 inch section. The pipe was held in a vertical position above the water then projected in the pond bottom. A rubber stopper was inserted in the top of the pipe before withdrawal from the pond. The suction created in the stoppered pipe resulted in the removal of a core from the pond bottom. The 8 inch detachable section was removed and a plunger was inserted to push the soil sample out of the pipe. When the core was removed, a sub-sample was taken from the top 2 inches. Three sub-samples were combined and placed in a pint metal container, labeled, and shipped to Thompson-Hayward Chemical Company for residue analysis.

RESULTS AND DISCUSSION

Field Experiments. The summer applications of 4 lb/A dichlobenil were more effective for the control of fragrant waterlily than the winter applications of 10 lb/A (Table 1). Shorter duration of control was obtained with winter applications than with summer applications. Maximum control for all herbicidal rates was apparent at 12 weeks after application and margins of the plots were very distinct. The rapidity of regrowth varied with the rate of application and the season of the year when the herbicide was applied.

A dichlobenil plus 2,4-D combination was not considered to be more effective than dichlobenil applied at a similar

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TABLE 1. EVALUATION OF GRANULAR DICHLOBENIL APPLIED ALONE AND IN COMBINATION WITH 2,4-D AT TWO SEASONS OF THE YEAR FOR THE CONTROL OF FRAGRANT WATERLILY.

Chemical	Rate lb/A	Application Date	Water depth (feet)	Percent control[1] Weeks after treatment 4	8	12	16	24	32	60	72
Dichlobenil	5	Winter	2.5	....	....	73	....	47	22	0	0
	10	1967		....	....	90	....	60	38	0	0
Dichlobenil	4	Summer	3.0	43	....	97	....	....	86	66	65
Dichlobenil + 2,4-D	4 + 4	1967		70	....	98	....	....	86	82	80
Dichlobenil	4	Winter	2.0	....	....	50	38	2	1	0	0
	8	1968		....	....	90	76	33	12	0	0
Dichlobenil	4	Summer	2.25	....	97	96	....	90	72	75	78
Dichlobenil + 2,4-D	4 + 4	1968		....	98	98	....	98	85	85	83
Dichlobenil	4	Fall	2.75	95	97	97	85	68	55	23	0
Dichlobenil + 2,4-D	4 + 4	1968		96	98	98	85	70	55	35	0
Dichlobenil	4	Summer	3.0	....	100	100	100	100	100	100	0
	6	1969		....	100	100	100	100	100	100	0
	8	1969		....	100	100	100	100	100	100	0
	10	1969		....	100	100	100	100	100	99	0
Dichlobenil	4 + 4	1969		....	100	100	100	100	100	99	0
Dichlobenil	5	Summer	3.0	....	98	98	97	93	95	91	0
	10	1970		....	99	99	99	98	97	93	0

[1]Average of 3 replications.

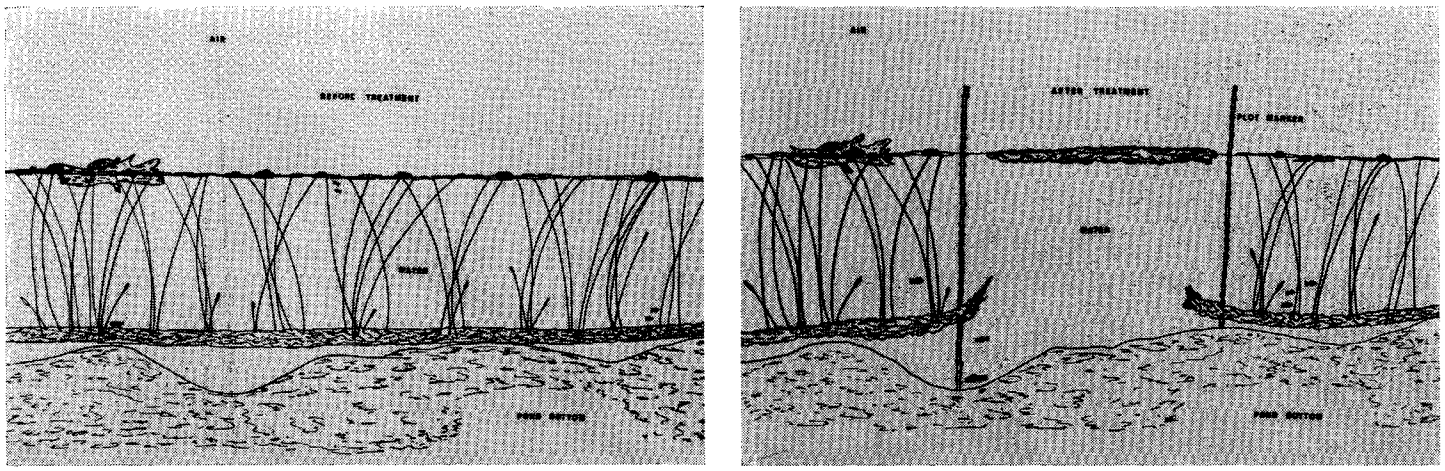

Figure 1. The above drawings illustrate the deterioration of fragrant waterlily rhizomes after treatment with 4 lb/A of dichlobenil. The floating organic material and rhizomes broke loose approximately 2 months after treatment.

TABLE 2. DICHLOBENIL RESIDUES IN WATER AFTER APPLICATION FOR CONTROL OF FRAGRANT WATERLILY.

Rate lb/A	Distance from treated areas (feet)	Concentrations in ppmw Days following treatment 1	2	4	8	16	32	74
5	0	0.16	0.14	0.10	0.01	0.01	0	0
10	0	0.35	0.28	0.15	0.02	0.01	0	0
5	50	....	0	0.01	0.01	0.01	0	0
10	50	....	0	0.01	0.02	0.01	0	0
5	100	....	0	0	0	0.01	0	0
10	100	....	0	0	0	0.01	0	0
5	200	....	0	0	0	0	0	0
10	200	....	0	0	0	0	0	0

TABLE 3. ANALYSIS OF HYDROSOIL FOR RESIDUE FOLLOWING APPLICATION OF DICHLOBENIL TO FRAGRANT WATERLILY.

Rate lb/A	Distance from treated areas (feet)	Concentrations in ppmw — Days following treatment						
		1	2	4	8	16	32	74
5	0	0.30	0.24	0.060	0.18	0.07	0	0
10	0	0.78	0.13	1.07	1.37	0.53	0.03	0
5	50	....	0	0	0	0	0	0
10	50	....	0	0	0	0	0	0
5	100	....	0	0	0	0	0	0
10	100	....	0	0	0	0	0	0
5	200	....	0	0	0	0	0	0
10	200	....	0	0	0	0	0	0

rate. In the areas treated with the combination, the rhizomes began to float carrying with them a layer of hydrosoil. Various types of vegetation including seedlings of fragrant waterlilies began to grow on the floating material (Figure 1). Examination of the floating rhizomes indicated they were severely damaged. Comes and Morrow (2) reported that rhizomes of dwarf waterlily (*Nymphaea tetragona* Georgi)) became detached and floated after dichlobenil treatments. The floating material began to disintegrate and sink after 4 months.

Application of dichlobenil in the fall of 1968 gave 95% control of fragrant waterlily. There was lateral movement of the chemical out of the treated areas because the water was flowing. Three months after treatment plants growing 75 feet from the treated plots were showing effects of dichlobenil. This movement of the herbicide caused a dilution of herbicidal concentration and a rapid regrowth of plants in treated areas.

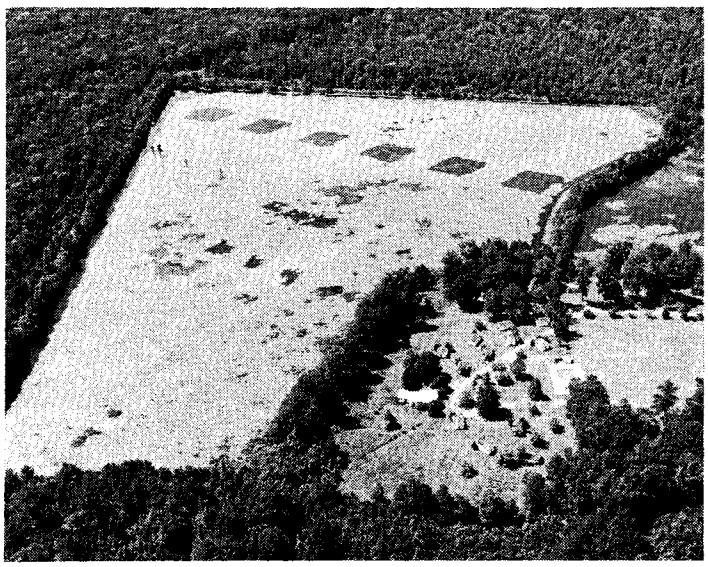

Figure 2. The dark square areas in the center of the photograph is fragrant waterlily treated 6 months earlier with a summer application of dichlobenil at 4 and 8 lb/A.

These field experiments have shown that dichlobenil can be used for the control of fragrant waterlily (Figure 2). Specialized equipment is not required for application in shallow ponds and lakes where fragrant waterlily presents a problem. Applications of 4 lb/A should be made during the summer months. Rhizomes may float to the surface several months after application. No advantage was observed for combination treatments of 2,4-D and dichlobenil.

Residue Study. The greatest residues of the herbicide in water and hydrosoil were found 1 day after application (Tables 2 and 3). No residue could be found in the water 32 days after treatment. However a concentration of 0.03 ppmw was detected in the hydrosoil of plots treated with 10 lb/A. A concentration of 0.01 ppm dichlobenil was found in the water 100 ft from the treated plots 16 days after treatment. No dichlobenil was detected in the hydrosoil outside of the treated plots.

The absence of residues in the hydrosoil outside of the treated plot is different from the results obtained by Comes and Marrow (2). They found a concentration of 49 ppbw in the hydrosoil 100 ft from an area treated with 7.5 lb/A, 350 days after treatment. Concurrently, they found 176 ppbw dichlobenil in the treated area. They concluded that the hydrosoil residues found outside of the treated area was a result of decomposing vegetation floating into untreated areas. We could find no dichlobenil in hydrosoil 74 days after treatment with 10 lb/A dichlobenil.

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