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Control of Spatterdock as Influenced by Time of Glyphosate Treatment[1]

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INTRODUCTION

Waterlilies of the genus *Nuphar* are perennial, yellow-flowered, aquatic plants with massive rhizomes containing stored food, and leaf blades which float on the water surface or project into the air. They occur in the shallow waters of lakes and ponds, in slow-moving streams, and in irrigation ditches where they often interfere with recreational uses of water and choke ditches to the point where flow is seriously impeded.

Chemical control methods for spatterdock have not been entirely satisfactory to date. Phenoxy compounds, notably 2,4-dichlorophenoxy acetic acid (2,4-D) has been used most frequently (2, 4). The herbicide 1,1′,-dimethyl-4,4′-bipyridinium ion (paraquat) has, however, been found to be ineffective (5, 8).

The herbicide N-(phosphonomethyl)glycine (glyphosate) has been reported to successfully control various species of *Nuphar* in Europe and the United States. *Nuphar lutea*

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(*L.*) was controlled with rates ranging from 1 to 3 kg/ha (1, 3), and *Nuphar advena* (Ait.) Ait. with rates ranging from 0.73 to 2.9 kg/ha (6, 7).[3] Riemer and Welker (5, 8) reported control of a form of *Nuphar,* which was intermediate between several species, using glyphosate at rates of 3.36 and 6.72 kg a.e./ha. The same intermediate form identified by Dr. Ernest O. Beal of Western Kentucky University, Bowling Green, KY, as intermediate between several species and sub-species but closest to *Nuphar luteum* subsp. *variegatum* is the form discussed in the present study.

MATERIALS AND METHODS

Experiments were conducted in irrigation ditches 60 to 90 cm deep, in which the water surface was almost completely covered by the spatterdock leaves. All treatments were replicated three times in a randomized complete block design. Each plot was 5 m long and included the entire width of the ditch, which varied from 2 to 3 m. The herbicide treatments were applied from the bank with a hand-carried sprayer, with a boom covering the entire width of the ditch. All herbicide treatments were applied at a pressure of 2.11 kg/cm^2 in 205 l of solution/ha. Glyphosate was applied at rates of 0.56, 1.12, and 2.24 kg a.e./ha (½, 1, and 2 lbs a.e./ha) in spring, early summer, late summer, and fall each year in 1979, 1980, 1981. The dates of treatment were as follows: 1979: June 13, July 13, August 20, and October 10; 1980: May 15, July 15, August 20, and October 9; 1981: May 7, July 30, August 26, and October 15. As a point of reference, spatterdock begins blooming in early May in New Jersey, where these studies were conducted. Phytotoxic response was estimated using a visual rating system with 0 = no injury and 100 = complete mortality. Ratings were made periodically; however, only those ratings made the summer after treatment are reported here, as they are the most meaningful when comparing treatments made from spring through fall.

RESULTS AND DISCUSSION

Glyphosate was found to be an effective herbicide for spatterdock control. Time of application of glyphosate greatly affected the degree of control (Table 1). Glyphosate was most effective when applied during the summer, while applications in either spring or fall were less effective. Glyphosate applied at a rate of 0.56 kg/ha in late summer was equal to 2.24 kg/ha applied in spring, and superior to 2.24 kg/ha applied in fall. Satisfactory control was obtained over an extended period of time when applications were made at a 2.24 kg/ha rate. Effective control was obtained within a shorter period when treating at 0.56 or 1.12 kg/ha.

Those glyphosate treatments that gave good control caused the roots that anchor the spatterdock rhizomes to decompose, resulting in the rhizomes floating to the surface. Examination of these rhizomes showed necrosis and decomposition of the growing points, while the remaining portion was soft and spongy.

[3]All rates have been converted for the convenience of the reader using 1.12 kg/ha = 1 lb/acre.

TABLE 1. CONTROL OF SPATTERDOCK WITH GLYPHOSATE AS INFLUENCED BY TIME OF APPLICATION. VISUAL EVALUATIONS WERE MADE APPROXIMATELY 12 MONTHS AFTER APPLICATION.

Time of treatment	Glyphosate rate (kg/ha)	Weed Control[a] 1979	1980	1981
Spring	0	0 g	0 h	0 e
	0.56	45 e	67 e	30 d
	1.12	80 c	88 c	85 b
	2.24	95 b	95 b	100 a
Early summer	0	0 g	0 h	0 e
	0.56	83 c	80 d	63 c
	1.12	100 a	100 a	100 a
	2.24	100 a	100 a	100 a
Late summer	0	0 g	0 h	0 e
	0.56	100 a	100 a	100 a
	1.12	100 a	100 a	100 a
	2.24	100 a	100 a	100 a
Fall	0	0 g	0 h	0 e
	0.56	0 g	0 h	0 e
	1.12	22 f	13 g	0 e
	2.24	53 d	60 f	67 c

[a]Means followed by the same letter within each column were not significantly different at the 5% level as determined by Duncan's multiple range test. Each value is the mean of 3 replications. Values based on visual rating scale of 0 = no effect and 100 = complete mortality and plant control.

The pattern of control is suggestive that the effectiveness of the herbicide is correlated to the plant's physiological activity. In the spring, the plant may be utilizing more energy for growth and is drawing more on its stored food reserves in the rhizomes. In the summer months with the secession of leaf production, the plant may be replenishing its stored food in the rhizomes. In the fall, it may be physiologically inactive. If the movement of glyphosate is associated with sugar movement in the plant, then the pattern of changing effectiveness through the season is understandable.

These experiments indicate that control of spatterdock can be achieved with a minimal amount of glyphosate by proper timing of the treatment. Less precise timing is required if higher rates of glyphosate are used.

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