Long-Term Effects Of Glyphosate Applications To Phragmites[1]

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ABSTRACT

N-(phosphonomethyl) glycine (glyphosate) was applied to phragmites (*Phragmites communis* Trin.) and the plots were observed for four growing seasons. The optimum rate of application appears to be in the range of 4 to 6 lb ae/A. Additional surfactant is effective only when the herbicide is applied at low rates. Within the range of 20 gpa to 80 gpa the effects of spray volume are minimal and can be ignored except with very low rates of herbicide. The application of glyphosate to phragmites for two successive years is a very effective means of control, even at rates as low as 2 lb ae/A each year.

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INTRODUCTION

Phragmites (*Phragmites communis* Trin.) is a plant of wide distribution, occurring in flood plains, tidal marshes, ditches, and other low-lying, poorly drained areas over much of the world. Although various civilizations have used this plant for thatching and other useful purposes, it is often detrimental to mankind's interests (1,3). It crowds out desirable wildlife food plants, its roots penetrate and clog various types of underground pipelines, and it poses a serious fire threat during the winter when the above-ground portions of the plant die and dry out. It is, therefore, desirable that safe, efficient, and economically feasible control methods be developed for phragmites.

One of the most recently developed herbicides which has shown promise for control of this species is *N*-phos-

phonomethyl) glycine (glyphosate) (2). The primary objective of this study was to observe the long-term effects of glyphosate when applied to phragmites once, and when applied twice in two successive years.

METHODS AND MATERIALS

The site chosen for the experiment is on the flood plain of the Cohansey River, approximately 1.5 miles south of Bridgeton in Cumberland County, New Jersey. The stand of phragmites is well established and vigorous, the plants reaching heights of 8 to 10 ft and the population density being so great that persons standing 4 ft apart cannot see each other. The ground is covered to a depth of 15 in or more with broken, partially decomposed phragmites stems and leaves.

The area was mowed during early April of 1972 to remove the dead, standing canes from the previous year which would have made access to the plots and spraying with a boom impossible. This mowing was done before any new growth had started. All plots were 21 ft by 21 ft (.01 A) with 6-ft untreated strips between plots. A completely randomized experimental design was used with two replications.

Glyphosate was applied with a CO_2-powered back-pack sprayer at rates of 2, 4, and 6 lb ae/A. In addition, each rate was applied in 20 and 80 gpa and also in 80 gpa with additional surfactant added at the rate of 1% of spray volume.[2]

The original treatments were made on 9 June 1972 at which time the new growth on the phragmites was 2 to 3 ft tall.

On 11 June 1973 a second application of glyphosate was made to one half of each plot which had been sprayed with 20 gpa in 1972. The rates of application on these half plots in 1972 and 1973 are shown in Table 1. The other half of each plot was left untreated in 1973 for comparison.

Visual ratings of the plots were made periodically throughout the growing seasons of 1972, 1973, and 1974. Separate ratings were made of stand density (number of plants occurring in the plot) and stand vigor (condition of the plants occurring in the plot without regard to number). The rating scale was 0 to 10 where 0 equals no effect and 10 equals complete control. All ratings were made independently by two observers and their ratings were averaged.

During the summer of 1975 the plots were observed but no formal ratings were made because of the invasion of many of the plots by plants from surrounding, untreated areas.

RESULTS AND DISCUSSION

The data from five rating dates will be presented in this paper. The five dates selected span the entire 3 years of the experiment and represent the trends which were observed with the various treatments. The results are presented in Figures 1 through 8.

[2]The surfactant used was undisclosed but was the same as that which was included in the glyphosate formulation being tested.

TABLE 1. RATE OF GLYPHOSATE APPLICATION (LB AE/A), AND SPRAY VOLUME (GPA), FOR THOSE HALF PLOTS SPRAYED IN BOTH 1972 AND 1973.

Treatment No.	1972		1973	
	lb ae/A	gpa	lb ae/A	gpa
4A	2	20	2	20
5A	4	20	2	20
6A	6	20	3	20

Effects of Spray Volume

The effects of spray volume (gal of solution applied per A) can best be seen by comparing Figures 1 and 2 with Figures 3 and 4. It will be seen that stand density (Figures 1 and 3), was not affected by spray volume at the 6 and 4 lb ae/A rates but at the 2 lb ae/A rate, a spray volume of 20 gpa was more effective than a spray volume of 80 gpa.

Plant vigor (Figures 2 and 4) was not influenced by spray volume except on the last rating date when the 2 lb rate of 20 gpa showed an unexplainably high rating and appeared to be much better than the 80 gpa treatment.

Plant vigor is a more vague concept than stand density. It includes height, color, stem diameter, leaf size, condition of flowers, and other factors. It is, therefore, much more difficult to rate than stand density, requiring considerable subjective judgment on the part of the person making the rating. As a result, the plant vigor ratings tend to fluctuate more from one date to the next than do the stand density ratings.

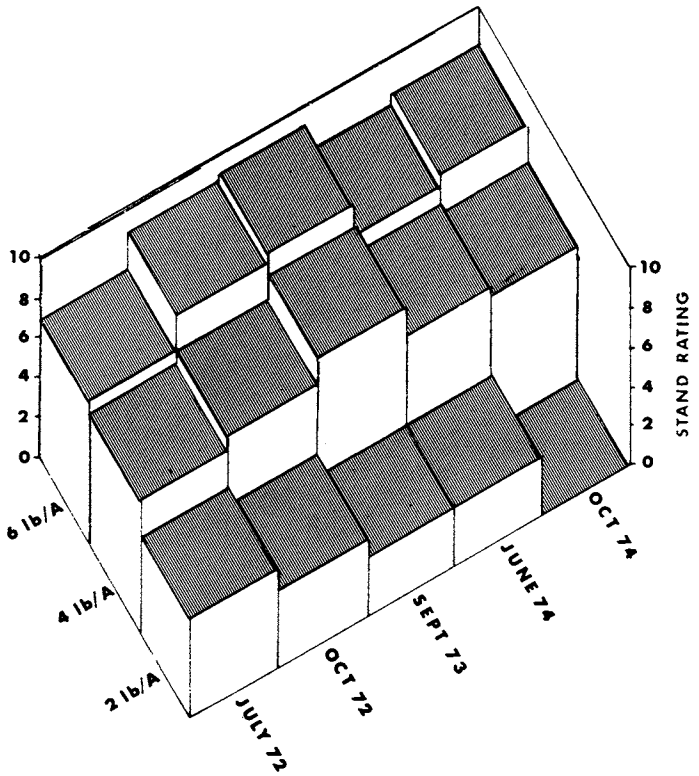

Figure 1. Stand density ratings of phragmites treated June 1972 with glyphosate in a spray volume of 80 gpa. Rating system is 0 to 10 where 0 equals no effect and 10 equals complete control.

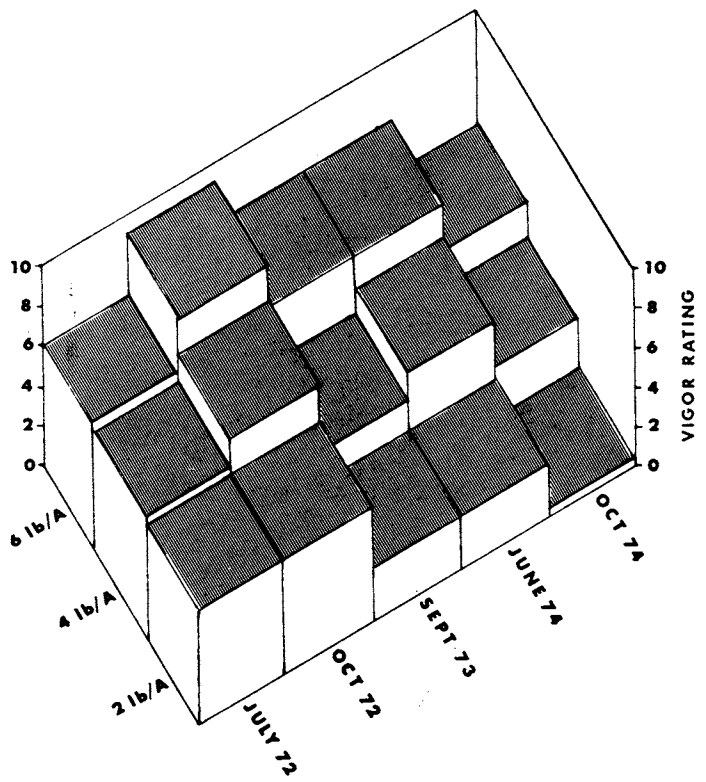

Figure 2. Vigor ratings of phragmites treated June 1972 with glyphosate in a spray volume of 80 gpa. Rating system is 0 to 10 where 0 equals no effect and 10 equals complete control.

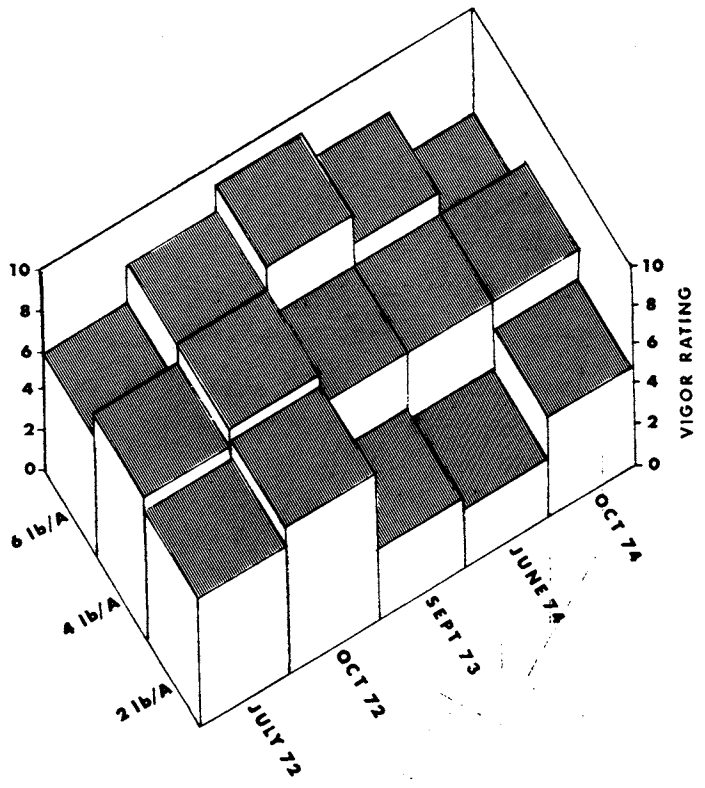

Figure 4. Vigor ratings of phragmites treated June 1972 with glyphosate in a spray volume of 20 gpa. Rating system is 0 to 10 where 0 equals no effect and 10 equals complete control.

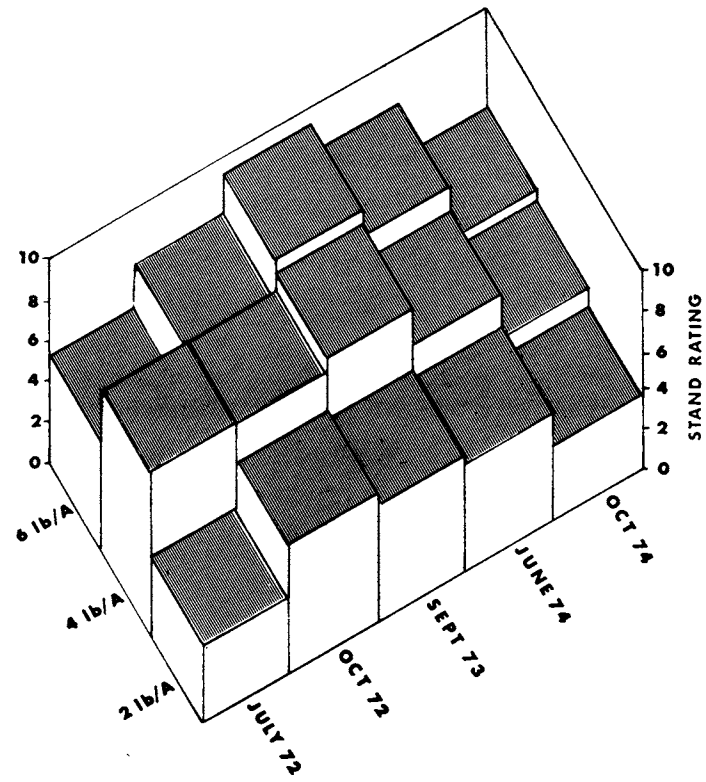

Figure 3. Stand density ratings of phragmites treated June 1972 with glyphosate in a spray volume of 20 gpa. Rating system is 0 to 10 where 0 equals no effect and 10 equals complete control.

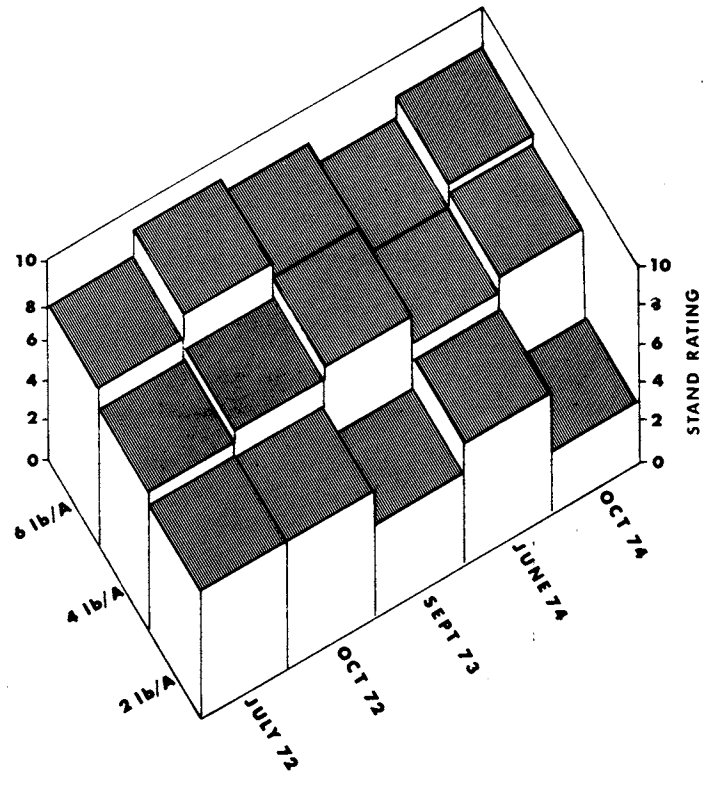

Figure 5. Stand density ratings of phragmites treated June 1972 with glyphosate and additional surfactant in a spray volume of 80 gpa. Rating system is 0 to 10 where 0 equals no effect and 10 equals complete control.

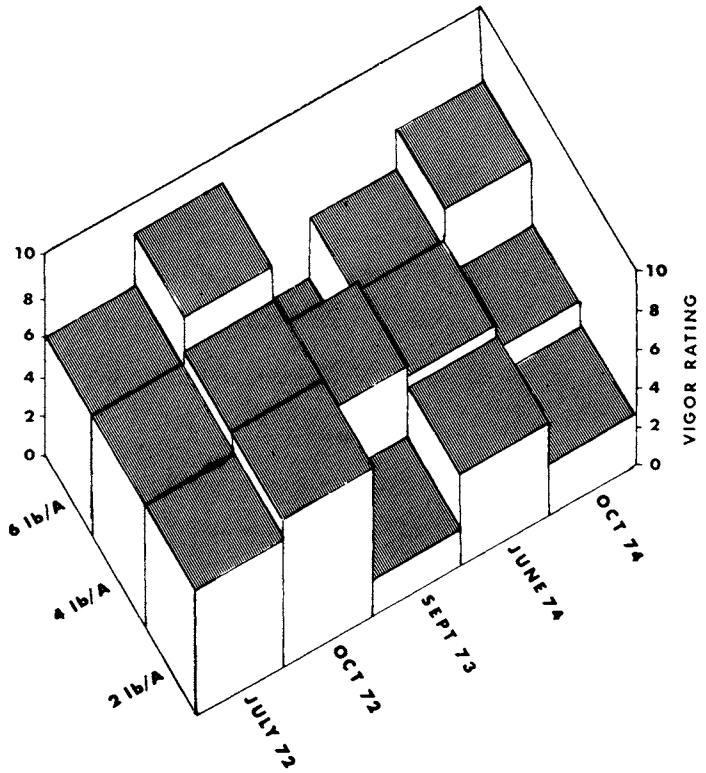

Figure 6. Vigor ratings of phragmites treated June 1972 with glyphosate and additional surfactant in a spray volume of 80 gpa. Rating system is 0 to 10 where 0 equals no effect and 10 equals complete control.

Effects of Surfactant

The effects of additional surfactant on stand density parallel the effects of spray volume on stand density; at the 6 and 4 lb rates there is no effect but at the 2 lb rate the additional surfactant resulted in somewhat better control. This can be seen by comparing Figures 1 and 5. The effects on plant vigor again tend to fluctuate and be less conclusive but there is a definite indication that the additional surfactant had an effect at the 2 lb rate but not at the 4 or 6 lb rate.

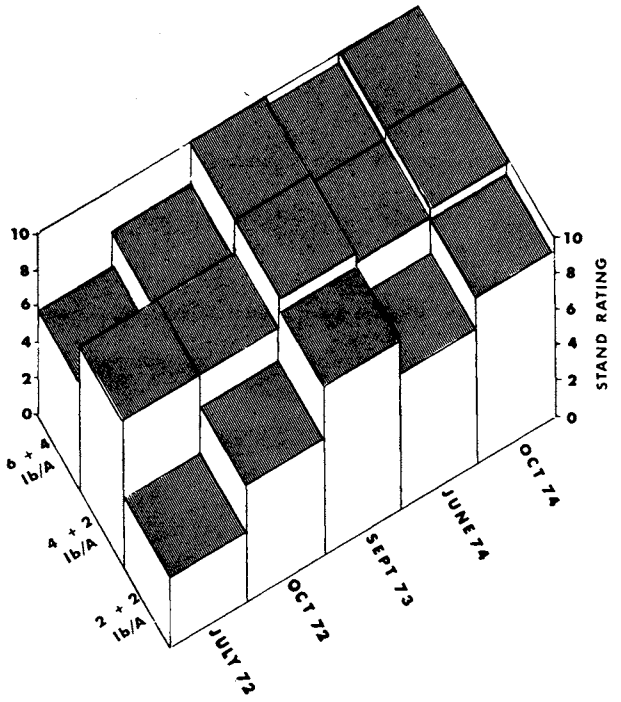

Figure 7. Stand density ratings of phragmites treated June 1972 and June 1973 with glyphosate in a spray volume of 20 gpa. Rating system is 0 to 10 where 0 equals no effect and 10 equals complete control.

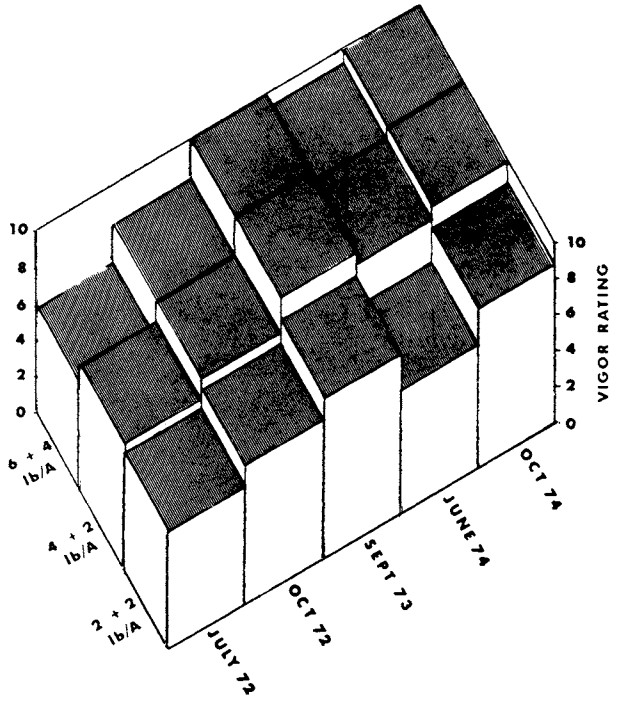

Figure 8. Vigor ratings of phragmites treated June 1972 and June 1973 with glyphosate in a spray volume of 20 gpa. Rating system is 0 to 10 where 0 equals no effect and 10 equals complete control.

Effects of Second Year's Treatment

The effect of treating phragmites for two consecutive years can be ascertained by comparing Figure 3 with Figure 7 (stand density ratings) and by comparing Figure 4 with Figure 8 (plant vigor ratings). It can be seen that the second treatment is quite effective in increasing and prolonging the degree of weed control attained. At the end of the third growing season, even the lowest rates of the retreated plots showed excellent weed control while the plots treated only once had declined to approximately 50% control in terms of both stand density and vigor.

This means that over a period of three growing seasons, excellent control of phragmites can be attained with 4 lb of glyphosate/A if those 4 lb are divided into two annual applications of 2 lb each. A single application of 6 lb does not give nearly as good control over the same period of time.

During the fourth growing season (August 1975), the experiment was observed but not rated. It was noted, however, that all plots receiving treatment for two consecutive years were totally free of phragmites, even those treated with the lowest rate.

The repeated application of 2 lb ae/A is more desirable from an environmental protection point of view because

there is less total herbicide being put into the environment and the concentration in the environment is even lower because it is being applied over a period of time.

From an economic point of view, the savings realized from using less herbicide would have to be compared to the additional cost of spraying the area twice instead of once.

LITERATURE CITED

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