Control Of Buttonball With Picloram

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INTRODUCTION

Buttonball (*Cephalanthus occidentalis* L.) grows as scattered clumps or thick coppice in the fluctuation zones of Tennessee Valley main river reservoirs to depths as much as 3 ft below top summer pool levels. Dense stands trap flotage and provide a breeding habitat for permanent pool mosquitoes (1). Buttonball also interferes with other water-use activities such as boating and is unsightly on lakefront property.

Mowing in late summer and early fall is effective in reducing nuisance buttonball in the subsequent year because regrowth does not begin until meristems emerse in midsummer by lowered lake levels. The Tennessee Valley Authority has an extensive and expensive biennial-triennial cutting program to attenuate the buttonball problem.[2] However, coppice can grow as much as 6 ft tall in a single season following dewatering of flooded stumps; therefore, annual mowing is required for maximum effectiveness but not for optimum economy.

Early attempts to control buttonball with (2,4-dichlorophenoxy) acetic acid (2,4-D) were ineffective (3). The more recently developed herbicide 4-amino-3, 5, 6-trichloropicolinic acid (picloram) was effective in controlling woody species that are tolerant to 2,4-D and 2,4,5-trichlorophenoxyacetic acid (2,4,5-T) (4).

In this paper, small-plot tests, applications by helicopter, and green house treatments are reported. Tests were designed to determine the effectiveness of picloram alone and in combination with 2,4-D, to determine the optimal treatment rate and time of application, and to determine comparability among greenhouse tests, small-plot treatments, and helicopter applications.

METHODS AND MATERIALS

Small-plot tests were conducted in the Harmon Creek Embayment of Kentucky Reservoir. This area contained an abundance of first-year coppice of buttonball. Plots 0.01 acre in size were sprayed with Tordon® 22K (24.9% potassium salt of picloram) or Tordon® 101 (10.2% triisopropanolamine salt of picloram plus 39.6% triisopropanolamine salt of 2,4-D)[3] at 0.125, 0.25, 0.5, 1, and 2 lb picloram acid equivalent per acre. Herbicides were diluted with lake water and applied at about 100 gal/acre. Applications were made eight times at biweekly intervals from mid-July to mid-October. Effectiveness of small-plot tests was evaluated by comparing clump counts of treated and untreated plots in August 1967 with similar clump counts in July 1966 at or before treatment. Results are expressed as average percentages killed at each rate for all treatment dates and at each treatment date for all rates.

Helicopter applications were made in August and September 1966 on first-year coppice of buttonball in three reservoirs with different water regimes. Each test area consisted of 10 acres or more treated with Tordon 101 at 0.25, 0.5, or 0.75 lb of picloram per acre (1, 2, or 4 lb 2,4-D per acre) diluted to 5 gal per acre. The helicopter equipment included a calibrated spray system with a multinozzle, airfoil boom. Effectiveness of these helicopter treatments was evaluated after about a year by counting living and dead clumps. Results were expressed as percentages killed in each treatment area.

Greenhouse treatments were made on buttonball seedlings grown in 4-inch plastic pots from seeds collected from Cane Creek below Colbert Steam Plant, Pickwick Reservoir. Pots contained bluestone gravel to facilitate bottom drainage and 12 inch[3] of Jiffy Mix®[4] covered with black sand. Before treatment, the plants were watered by placing the pots in porcelain pans with the water level about 0.5 inch below the surface of the sand. After treatment, the plants were watered on the surface three times a week. Herbicides were tested by pipetting 0.0034 fluid ounces in small droplets onto the upper surface of a single, completely expanded leaf near the top of a 3 to 8-inch seedling. Evaluation was made by observing necrosis and epinasty, and by counting survivors after 2 months.

RESULTS AND DISCUSSION

Clump density in eight untreated small plots decreased 13% from 1966 to 1967. Results from test plots were corrected for the decrease in density in untreated plots by Abbott's formula (2). Picloram reduced clump density in proportion to dosage (Figure 1). The two formulations gave similar rate responses. Smaller coppice was slightly less sensitive to Tordon 101 (Figure 2). Buttonball had two peaks of seasonal sensitivity to picloram—one in mid-August and one in mid-September (Figure 3). Treatments

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[2]Tennessee Valley Authority. 1967. Victor control program definition, F.Y. 1968. Unpublished report. 26 pp, 8 appendices.

[3]Use of trade names is for identification purposes only and does not constitute endorsement by the Tennessee Valley Authority.

[4]A commercial, fertilized mixture of vermiculite and peat moss available from CASSCO, P.O. Box 550, Montgomery, Alabama.

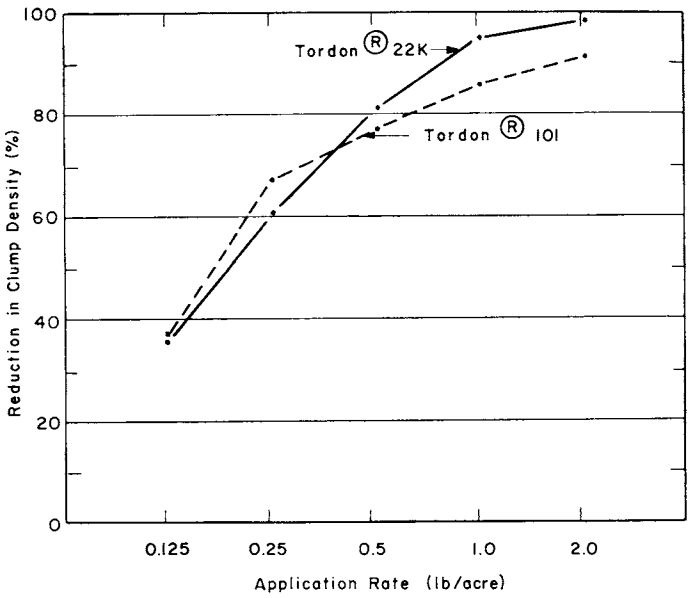

Figure 1. Effect of rate of application of Tordon® 101 and Tordon® 22K on reduction in density of buttonball clumps, Kentucky Reservoir.

in late August and in October produced less reduction in clump density. In tests of seasonal variation, height of the first-year coppice varied between treatment plots because the recession water level schedule used on Kentucky Reservoir resulted in variation in the time of stubble dewatering and consequently in the size of regrowth.

Picloram sprayed by helicopter was more lethal to buttonball than that applied in the small-plot tests at an equivalent rate (Table 1). Picloram applied by helicopter at rates of 0.5 lb per acre killed 97% or more of treated clumps.

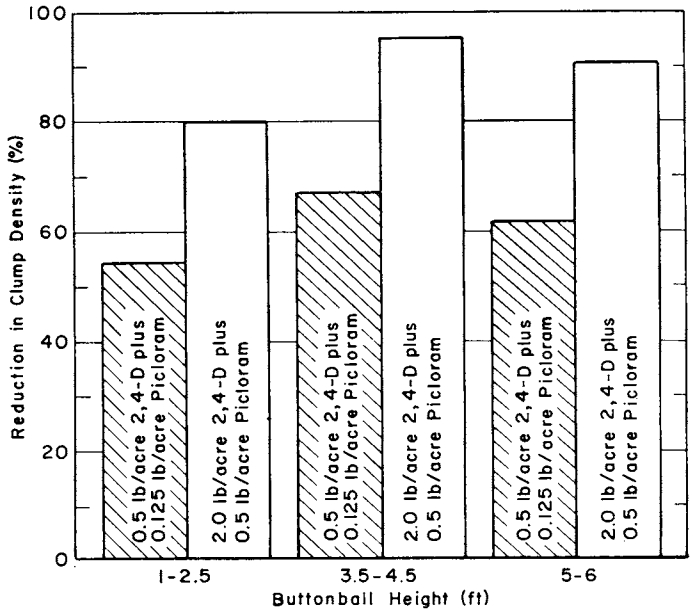

Figure 2. Effect of height of buttonball at time of herbicidal treatment in reduction of density of clumps by picloram plus 2,4-D (Tordon® 101).

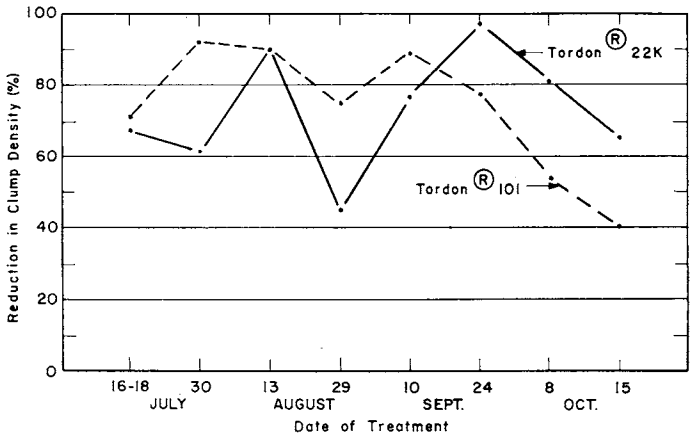

Figure 3. Effect of treatment date on the lethality to buttonball of Tordon® 101 and Tordon® 22K, Kentucky Reservoir.

The lowest application rate used in greenhouse tests of picloram, 4.3 x 10^{-8} ounces picloram per plant, caused epinasty of the treated leaf. The minimum dose needed to kill individual seedlings was 2.6 x 10^{-6} ounces picloram per plant. Comparison, based on foliage projection area, of greenhouse dose rate with small-plot treatment and with helicopter application rate indicated that greenhouse treatment with picloram is about 10 times more effective than field treatment.

CONCLUSIONS

The major conclusion to be drawn from both small-plot and helicopter field tests is that picloram can be used to greatly reduce density of first-year coppice of buttonball along the Tennessee River reservoirs. A single application of picloram by helicopter was much more effective and more economical than repetitive mowing operations. Greenhouse treatments of buttonball with picloram were more effective than field treatment, probably because of more effective delivery of herbicide to the plant and smaller plant size. Greenhouse studies can be used for extrapolating to field applications only if appropriate conversion factors are developed.

TABLE 1. CONTROL OF FIRST-YEAR COPPICE OF BUTTONBALL BY HELICOPTER OF A MIXTURE OF TORDON® 101.

Reservoir and Area	Rate[a] (lb Picloram/acre)	Kill (%)
Kentucky		
Scott-Fitzhugh	0.50	99
Swan Bay	0.75	97
Pickwick		
Yellow Creek	0.50	99
Wheeler		
Fox Creek	0.50	100
Mallard Creek	0.25	83

[a]Tordon® 101, also includes 2,4-D at four times the picloram rate.

1. Breeland, S. G., W. E. Snow, and Eugene Pickard. 1961. Mosquitoes of the Tennessee Valley. J. Tenn. Acad. Sci. 36:278.
2. Brown, A. W. A. 1951. Insect Control by Chemicals. John Wiley & Sons, Inc., New York, p. 764.
3. Hall, T. F. and A. D. Hess. 1947. Studies on the use of 2,4-D for the control of plants in a malaria control program. J. Nat. Mal. Soc. 6:99-116.
4. Watson, A. J. and M. G. Wiltse. 1973. Tordon for brush control on utility rights-of-way in the Eastern United States. Down to Earth 19:11-14.