J. Aquat. Plant Manage. 21: 106-107 (Notes)

Phytotoxicity of DPX 5648 to Waterhyacinth[1]

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INTRODUCTION

Waterhyacinth (*Eicchornia crassipes* [Mart.] Solms) was reportedly introduced into the United States in 1884 during the International Cotton Exposition in New Orleans, LA. An extremely aggressive growth habit, prolific reproductive abilities, and a wide range of environmental tolerances (3,4), have allowed waterhyacinth to rapidly spread throughout Florida and the southeastern coastal states as far north as Virginia, as far west as California, and throughout the tropics. In Florida, waterhyacinth was found in 33% of all lakes surveyed in 1979 by the Florida Division of Natural Resources, and in 58% of the rivers (3). This amounts to 4,656 ha of waterhyacinth coverage in 375,671 ha of water surface. In addition, 5,263 ha were reported in 10,121 to 14,170 ha of canals.

Heavy infestations of waterhyacinth can cause serious environmental and economic impacts. Light penetration, pH, and dissolved oxygen concentration are severely depressed under waterhyacinth mats (2) with subsequent decreases in fish production (6,7). Agricultural irrigation can be impacted by evapotranspiration effects (1,7,10) and impedence to water flow. Additional economic impacts can result from obstruction of both recreational and commercial navigation. The problems associated with waterhyacinth infestations have resulted in intensive federal, state, and local programs to control growth of this plant.

A potential limitation of these programs is that herbicides containing only two active ingredients, diquat (6,7-dihydrodipyrido[1,2-α: 2′, 1′-c] pyrazinediium ion) and 2,4-D((2,4-dichlorophenoxy)acetic acid) are labelled for waterhyacinth control. The major portion of herbicide application to waterhyacinth employs 2,4-D formulations. In 1977, 304 kl of formulated 2,4,-D were used in waterhyacinth control programs in the state of Florida, at an estimated cost of $95 per ha (5). The serious consequences which would result from loss of registration for one or both of these chemicals is obvious. It is, therefore, essential to continue evaluating currently manufactured terrestrial herbicides for their suitability in a waterhyacinth control program.

DPX (Methyl 2[[[[(4,6-dimethyl-2-pyrimidinyl)amino]-carbonyl]amino]sulfonyl]benzoate) is a new herbicide which is currently marketed by Dupont Inc., under the tradename Oust.[3] Oust is currently labelled for noncropland weed control on a broad spectrum of annual and perennial grasses and broadleaf vegetation. The principal mode of action of Oust is an arresting of cell division in the growing tips of roots and shoots. This is a desirable characteristic for an aquatic herbicide because it allows for the slow death of the plants, thus, reducing the danger of fish mortality when dissolved oxygen is lowered from rapidly dying and decaying plant tissue. This slow rate of control, combined with a low toxicity (5,000 mg/kg LD_{50} for rat), make DPX 5648 an attractive herbicide for waterhyacinth control.

Experimental applications of DPX 5648 have shown effective herbicidal activity at low treatment rates on a broad spectrum of submersed and floating aquatic vegetation (8, 11). We were, therefore, interested in evaluating the phytotoxicity of DPX 5648 on waterhyacinth.

MATERIALS AND METHODS

Waterhyacinth plants were collected on May 22, 1981 from Orange Lake (Alachua County, Florida). Ten plants each were placed into 30 plastic lined containers (60 cm deep by 40 cm dia) filled with 75 l of well water out-of-doors. The plants were allowed to become established for one week before treatment. A commercially available 10-10-10 fertilizer was added to the water initially, and after 3 weeks, to provide for an addition of 24 mg nitrogen, phosphorus and potassium per liter.

Three replications each of 1, 5, 10, and 20 g DPX 5648 per ha were either applied foliarly or to the water column. An 80 WP formulation of DPX 5648 was used and 0.25% Cide-Kick was included in all treatments. A 0.25% Cide-Kick solution was applied to three replicates in order to test for phytotoxic effects of the surfactant. Foliar applications were made with a manually operated plastic spray bottle at a rate equivalent to 935 $l \cdot ha^{-1}$ (100 $gal \cdot a^{-1}$). Water column treatments were manually stirred into the containers. Phytotoxicity ratings were made 2, 3, and 12 weeks posttreatment as subjective percent control compared to checks. Ratings were obtained from three individuals.

RESULTS AND DISCUSSION

Two weeks after application of DPX 5648 all treatments showed leaf necrosis starting at the distal portion of the leaf. In addition, some of the plants in water column treatments showed necrosis at the bases of the petioles. The latter observation may indicate that, at least, part of the phytotoxic response in water column treatments may result from foliar uptake where the base of the plant comes in contact with the water rather than resulting from root uptake.

In addition to tissue necrosis, a general stunting response was observed with all treatments as compared to growth of controls. A phytotoxic effect was not observed in response to the 0.25% Cide-Kick solution.

[1]Funding for this project was provided in part by the U.S. Department of Agriculture, ARS Cooperative Agreement No. 58-7B30-0-177. Published as Journal Series No. 4539 of the Florida Agricultural Experiment Station.

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[3]Mention of a trademark name or a proprietary product does not constitute a guarantee or warranty of the product by the University of Florida or the U.S. Dept. of Agriculture and does not imply its approval to the exclusion of other products that also may be suitable.

When the percent control of waterhyacinth over a 3-week period was regressed over treatment rate (Figure 1) it was shown that the regression line for foliar application had a significantly greater midpoint and intercept than the water column application but a significantly smaller slope coefficient. This suggests that for a given treatment rate, greater control can be expected after a 3-week period with foliar treatment than with water column treatment, but control is more sensitive to treatment rate when water column treatment is used.

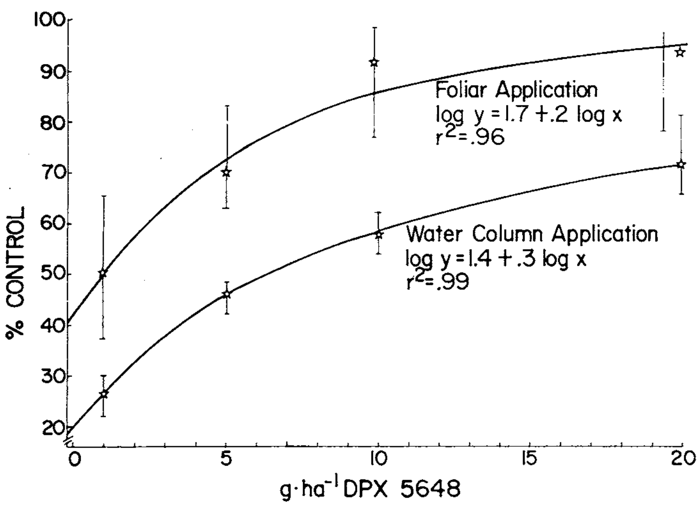

Figure 1. Control of waterhyacinth using foliar or water column application and different treatment rates of DPX 5648 (vertical bars enclose 95% confidence limits of the mean response, stars represent observed average response, n = 4).

Complete death of waterhyacinth plants was observed after 12 weeks with all combinations of treatment levels and application methods. These results are similar to those of Van and Steward (11) who observed control after 10 weeks with 10 g•ha^{-1} treatments.

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