Purple Nutsedge Suppression with Soil-applied Paclobutrazol

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Purple nutsedge (*Cyperus rotundus* L.) is difficult to control and one of the world's worst weeds (Holm et al., 1977). Cytokinins (Teo and Nishimoto, 1973) and 2-chloro-9-hydroxy-9H-fluorene-9-carboxylate methylester (morphactin) (El-Masry and Rehm, 1977) enhanced nutsedge tuber sprouting, but we found no reports of suppression of rhizome growth or tuber production with growth regulators. In yellow nutsedge, soil-applied gibberellic acids altered rhizome orientation (Bendixen, 1970). Because β -[4-chlorophenyl)methyl]- α -(1,1-dimethylethyl)-1H-1,2,4-triazole-1-ethanol (paclobutrazol) interferes with gibberellin synthesis (Graebe, 1987), it may suppress underground growth of purple nutsedge. The objective of this study was to determine if paclobutrazol would suppress purple nutsedge propagule production while allowing leaf growth for absorption of foliar herbicide sprays.

Tubers and soil (Waialua, very-fine, kaolinitic, isohyperthermic, Typic Haplustoll) were collected at the Waimanalo Experiment Station, Waimanalo, Hawaii, on 1 Dec. 1989. The soil was fumigated with 4.5 g methyl bromide/liter and sieved through a 5-mm mesh screen. On 5 Dec. 1989, 40 tubers weighing 0.6 to 0.8 g each were planted 2 cm deep in 1-liter black plastic containers.

In the drench treatment, 20 ml aqueous solution of paclobutrazol (50% wettable powder) at 0, 0.5, 2, or 8 mg a.i./liter soil was poured onto the soil followed by an additional 80 ml water; in the incorporation treatment paclobutrazol was premixed with the soil. Tubers were planted and 100 ml water was applied. The range of paclobutrazol concentrations was based on previous reports (Johnson, 1990; Stang and Weis, 1984). Each container received 0.55 g slow-release 18N-2.6P-9.9K fertilizer and 20 mg minor elements (Micromax, Grace Sierra, Milpitas, Calif.) and then was placed on outdoor benches and watered twice daily.

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Plants were harvested 31 Jan. 1990, when nontreated plants reached anthesis. Data recorded were rhizome length (1-mm minimum), number of propagules produced (excluding planted tuber and primary basal bulb, 2-mm-diameter minimum), and length of the largest leaf. During the 57 days of growth, daily air maxima fluctuated between 21 and 31°C and daily minima between 13 and 21°C.

Treatment design was factorial, two application methods $\times$ four paclobutrazol levels, with five replications. The experimental design was completely randomized, and the experimental unit was a rhizome system developed from a parent tuber. Plant responses to the treatments were regressed with modified power functions (Spain, 1982) using SAS GLM and NONLIN procedures (SAS Inst., 1990).

Plants in control pots produced 1177 ± 182 mm (mean $\pm$ 95% confidence intervals) total rhizome length compared with 343 ± 163 mm for those with paclobutrazol at 0.5 mg a.i. Purple nutsedge rhizomes were almost eliminated at 2 and 8 mg a.i. Regressing the concave response with a modified power function (Fig. 1A) was satisfactory, as the model estimated means (1168 and 324 mm for 0 and 0.5 mg a.i., respectively) within 95% confidence intervals. Because no significant difference was found among two application methods, one prediction equation was developed with the combined data.

The number of propagules produced in response to paclobutrazol concentration (Fig. 1B) followed the same trend as total rhizome length. Tuber production was suppressed by paclobutrazol at 0.5 mg a.i. and completely inhibited at 2 and 8 mg a.i.

Leaf length also showed a concave response to paclobutrazol treatments (Fig. 1C), but leaf elongation was not completely inhibited at the highest paclobutrazol level. While leaves from nontreated soil were 201 mm long, paclobutrazol applications at 2 and 8 mg a.i. limited leaf length to 96 and 64 mm, respectively.

In summary, purple nutsedge growth was suppressed by paclobutrazol soil drench or incorporation. Rhizome growth and propagule production were eliminated by paclobutrazol at 2 and 8 mg a.i./liter soil, while leaf length was limited to 48% and 32%, respectively, of nontreated plants.

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Fig. 1. Purple nutsedge total rhizome length (A), number of tubers produced (B), and leaf length (C) 57 days following soil applications of paclobutrazol at 0, 0.5, 2, or 8 mg a.i./liter. The responses ($\circ$) were regressed with modified power functions ($\rightarrow$): total rhizome length (in millimeters) = $(0.192 + 0.134 \times \text{paclobutrazol})^{-4.28}$, number of tubers produced = $(0.760 + 0.163 \times \text{paclobutrazol})^{-8.77}$, and leaf length (in millimeters) = $62.47 + 1.03 \times (0.520 + 0.054 \times \text{paclobutrazol})^{-7.49}$, where paclobutrazol (in milligrams) is a.i./liter soil.

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