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NOTES

Selectivity of Metsulfuron Methyl to Six Common Littoral Species in Florida

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INTRODUCTION

Metsulfuron methyl (Escort®) (methyl 2-[[[[(4-methyoxy-6-methyl-1,3,5-triazin-2-yl)amino]-carbanyl]amino]sulfonyl]benzoic acid] is a selective sulfonylurea herbicide used to control broadleaf species and some annual grasses in pasture, rangeland, rough turf, noncrop areas and conifer plantations (Boutin et al. 2000, Anonymous 1986). It is a systemic herbicide having pre and postemergence activity (Dupont 1999).

Sulfonylurea herbicides act specifically by inhibiting the enzyme acetolactate synthase (ALS), which is involved in the biosynthesis of valine, leucine and isoleucine in both plants and microorganisms (Fahl et al. 1995). Soon after herbicide application, plant cell division stops quickly and plant death occurs within one to three weeks (Brown 1990).

The sulfonylurea herbicides are applied at rates of g/ha (maximum label rate = 280 g/ha) rather than kg/ha, with some species being very sensitive and others very tolerant. Residual activity in soil and presence in water depends heavily on pH, temperature, organic matter, rainfall, and, to a lesser extent microorganisms. Photolysis and volatilization seems to be of minor importance in the degradation of most sulfonylurea herbicides (Blair and Martin 1988, Smith 1986, Anonymous 1986).

Previous phytotoxicity studies reveal that metsulfuron methyl is toxic to micro-algae with effective concentrations producing 50% growth reduction (EC_{50}) in the range of 600-8000 µg/l (Wei et al. 1998, Nyström and Blanck 1997, Fahl et al. 1995). Boutin et al. (2000) reported vegetative growth and reproductive performance of *Mimulus ringens* L., *Bidens cernua* L., and *Echinochloa crusgalli* [L] Beauv. were affected by metsulfuron methyl drift at 0.45 g a.i./ha. Some species are also very sensitive to low concentrations of metsulfuron methyl in the aquatic environment. For example, Roshon et al. (1999) reported IC_{50} values of 0.22 µg/l for root growth of *Myriophyllum sibiricum* Komarov following a 14 day static *in vitro* exposure. There evidently is a high inter-species variation among macrophytes and micro-algae in sensitivity to this compound (Nyström et al. 1999).

Many Central Florida lakes, particularly those in the Kissimmee River watershed, are maintained 0.5 to 1.0 m lower than historic (pre-1960) levels during the summer hurricane season for flood control purposes. These lower water levels have allowed proliferation and formation of dense monotypic populations of pickerelweed (*Pontederia cordata* L.) and other broadleaf species that out compete more desirable native grasses (Hulon, pers. comm., 2002). Due to the limited availability of data on the effects of metsulfuron methyl on wetland plants, particularly in Florida, the present study was carried out with the objective of testing its phytotoxicity on six wetland species, to determine the feasibility of its use for primary pickerelweed control.

METHODS AND MATERIALS

Aquatic plants (cutting and young plants) were collected from central Florida lakes and planted in 3L pots (17.2 cm diameter by 13.0 cm deep) in Gainesville. Each pot was filled with locally purchased topsoil to within 5 cm of the top of each pot, and approximately 4 cm of sand was placed on the surface. A total of 5 grams of 15-9-12 slow release Osmocote® was incorporated throughout the soil in each pot. Additional nutrients were added as needed after plants became established using Peter's 20-20-20, and pots were partially submerged in approximately 10 cm of water to provide a continuous water supply. Plants were grown for 90 d prior to application of Escort XP (60% a.i.) on October 3, 2003. Plants were foliarly treated at rates of 0.0, 17.5, 35.0, 70.0, and 140.0 g a.i./ha (0.0, 0.25, 0.5, 1.0 and 2.0 oz of formulation/acre), through a forced air CO_2 sprayer with a single XR Teejet 8002 VS nozzle at 15 PSI. A total of 935 l/ha diluent was used with 0.5% v/v silicone surfactant. Control plants were sprayed with diluent containing only surfactant with no herbicide. On November 4, 2003 all above ground green tissue (regrowth and unaffected plants) was harvested from each pot and placed into a drying oven and dry weights determined. Analysis of variance and means comparison test was completed using the SAS statistical software (SAS 1988).

RESULTS AND DISCUSSIONS

Torpedograss (*Panicum repens* L.), knotgrass (*Paspalum distichum* L.), and paragrass (*Brachiaria mutica* (forssk.) stapf) were unaffected by metsulfuron methyl applied at rates of up to 140.0 g/ha (Table 1). Soft-stem bulrush (*Scirpus validus* Vahl) growth was reduced at the highest application rate.

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TABLE 1. SHOOT DRY WEIGHT OF SIX LITTORAL SPECIES 32 DAYS AFTER APPLICATION OF VARIOUS RATES OF METSULFURON METHYL. EACH VALUE IS THE MEAN OF SIX CONTAINERS.

	Species (g per container)[a]					
Rates (gai/ha)	Knotgrass	Paragrass	Torpedograss	Bulrush	Pickerelweed	Arrowhead
0.0	14.8	65.2	19.4	12.9 a	15.2 a	3.9 a
17.5	14.9	58.7	16.5	9.6 ab	1.0 b	0.0 b
35.0	18.4	76.7	21.2	11.5 ab	0.9 b	0.0 b
70.0	13.7	56.6	25.3	10.3 ab	1.1 b	0.0 b
140.0	13.7	57.8	24.3	4.5 b	0.0 b	0.1 b
LSD	4.7	55.7	0.6	7.0	4.0	0.9

[a]Values within a column followed by the same letter are not significantly different according to the LSD mean separation test (p = 0.05).

In contrast, metsulfuron methyl had a dramatic effect on pickerelweed and arrowhead (*Sagittaria lancifolia* L.), producing essentially complete control of arrowhead and over a 90% reduction in pickerelweed biomass at rates of 17.5 g/ha. It required an application of 140.0 g/ha to provide total control of pickerelweed in this study, but we believe incomplete coverage of pickerelweed may have occurred at the lower rates. Pickerelweed growth was very dense (control plants had four times the mass of arrowhead) and we believe incomplete coverage of pickerelweed was an issue. In preliminary trials (data not shown), 35.0 g/ha and 70.0 g/ha provided complete control of pickerelweed plants that appeared to be less dense than those treated in this study. This suggests that good coverage, as with most herbicides, is important to obtain optimum control of susceptible species with metsulfuron methyl.

Metsulfuron methyl was very selective, controlling the broadleaf monocot species but not affecting the perennial grasses. Consequently, this herbicide would be a candidate for use in selectively controlling certain broadleaf species in lake drawdown and restoration sites if appropriate labeling can be obtained.

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