The Effect of Mesotrione and Atrazine on Photochemical Efficiency of Centipedegrass (Eremochloa ophiuroides).

J. Scott McElroy, Plant Sciences Department, University of Tennessee

ABSTRACT

Atrazine is often used during the establishment of centipedegrass for control of annual weeds such as crabgrass (Digitaria spp.). Tank-mixing of mesotrione with photosynthesis inhibiting herbicides such as atrazine have been shown to be synergistic. Research was conducted to evaluate the effect of atrazine and mesotrione, both alone and in tank-mixure, on centipedegrass photosynthesis, including light-harvesting, non-photochemical quenching, construction of the photosynthetic apparatus, and carotenoid generation and reduced buffering for free radical sequestration.

RESEARCH GOAL
Evaluate centipedegrass tolerance to mesotrione, atrazine, and mesotrione-atrazine combinations utilizing the metrics of photochemical efficiency and turfgrass cover.

INTRODUCTION

- **Centipedegrass**: Warm-season turfgrass species, often difficult to establish due to competition from uncontrolled weed species, primarily crabgrass (Digitaria spp) and goosegrass (Eleusine indica). Centipedegrass is one of the primary herbicides used in establishment of centipedegrass for control of annual grasses.
- **Atrazine**: PSII inhibiting herbicide that directly inhibits movement of electrons from PSI to P700 along the electron transport chain. Results in massive free radical generation and overload.
- **Mesotrione**: Herbicide that indirectly inhibits phytoene desaturase, a key step in the formation of all carotenoids and xanthophylls. Directly inhibits the formation of tocopherols and tocotrienols.
- **Carotenoids and xanthophylls**: Key components in photosynthesis, including light-harvesting, non-photochemical quenching, construction of the photosynthetic apparatus, and free radical sequestration.
- **Tocopherols and tocotrienols**: Key antioxidants in turfgrass.
- **Synergism**: Atrazine and mesotrione combinations are known to be synergistic due to the concomitant free radical generation and reduced buffering for free radical sequestration.

MATERIALS AND METHODS

- **Centipedegrass**: was seeded with approximately 50 seed per pot into 10 cm diameter pots filled with Sequatchie loam soil.
- **Seed emergence**: approximately 14 days after seeding. Pots were fertilized with a complete fertilizer (20-20-20 plus micronutrients) at 25 kg N ha at emergence.
- **Treatments**: were applied 14 days after emergence (DAE) utilizing a single flat fan nozzle applied at 280 L/ha.
- **Photochemical efficiency**: was measured using a pulse-modulated fluorometer (Opti-Sciences, http://www.optisciences.com). Three measurements per pot were taken every 7 days for 28 days (Maxwell and Johnson 2000).
- **Percent turf cover** was analyzed utilizing digital analysis (Karcher and 2004).

RESULTS

- **All atrazine containing treatments reduced Fv/Fm at 7 DAA > 65% (Figure 3)**. All mesotrione alone treatments reduced Fv/Fm less than all atrazine containing treatments.
- **Low rates of atrazine (0.28 kg/ha) plus high rates of mesotrione (0.28 kg/ha) were more detrimental to Fv/Fm over time than a high rate of atrazine (2.24 kg/ha) plus a low rate of mesotrione (0.035 kg/ha). Tank-mixtures were also the most detrimental to turf cover as well (Table 1)**.
- **Fv/Fm of mesotrione treated plants recovered by 28 DAA. It is also noted that Fv/Fm of plants treated with mesotrione 0.28 kg/ha was greater than the non-treated. Atrazine alone at 0.24 kg/ha was the only atrazine containing treatment to completely normalize by 28 DAA.**

CONCLUSIONS

- **While utilized for weed management in centipedegrass when applied preemergence, atrazine is detrimental to PSII efficiency and to overall plant health when applied early postemergence. Thus, the use of atrazine should be limited to at seeding, preemergence applications when utilized for seeding establishment.**
- **Mesotrione is a potential safer alternative to atrazine for use early postemergence on newly seeded centipedegrass.**

LITERATURE CITED
