RESIDUAL HERBICIDE DISSIPATION FOR BARE-SOIL VERSUS SOIL UNDER LOW DENSITY POLYETHYLENE MULCH

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Yellow nutsedge (*Cyperus esculentus*) and purple nutsedge (*C. rotundus*) are the most common and troublesome vegetable weeds throughout the southern US. Herbicides that could be incorporated into low density polyethylene (LDPE) mulch systems must control *Cyperus* species to be effective. Halosulfuron-methyl, sulfentrazone, and *s*-metolachlor all have *Cyperus* species activity. Metolachlor has been previously investigated for purple nutsedge control in combination with fumigants, while halosulfuron and sulfentrazone in combination with fumigants is currently under investigation. Preemergence (PRE) herbicides applied under the LDPE mulch to control nutsedge have specific registrations and rotational restrictions for vegetables. This is due to their residual activity.

Therefore, the dissipation of these three soil-applied residual herbicides was compared in bare-soil and soil under LDPE mulch in 2003 and 2004 under field situations in Georgia. Herbicide treatments included halosulfuron at 39 g ha^{-1}, *s*-metolachlor at 1285 g ha^{-1}, and sulfentrazone at 280 g ha^{-1}. Herbicides were applied in the spring of each year. Half of each plot was then covered with the same LDPE 30 minutes after treatment. Each site used a randomized complete block with treatments arranged as a split plot with four replications. Soil cores were collected at 1 h, 1, 2, 14, 27, and 56 days after treatment (DAT) in 2003 and 1 h, 1, 2, 3, 7, 14, 21, 28, 44, and 66 DAT in 2004. All samples were immediately frozen upon collection and stored at -10 C prior to analysis. For herbicide analysis after sample preparation, a Waters Alliance 2690 system coupled to a Micromass Quatro was used to analyze the samples using electrospray ionization using standard curves generated from technical materials for each herbicide. Data were subjected to non-linear regression in addition to ANOVA for a split-plot randomized complete block design. Regression analysis was performed and fitted to the exponential decay equation. Herbicicde recovery was regressed against time in days, the output from the analysis included the first-order dissipation rate constant (k). The time for 50% of the herbicide to dissipate (DT_{50}) was then determined. Bioassays were performed for the 2004 soil samples using a species deemed sensitive to each herbicide: oat for *s*-metolachlor, cotton for sulfentrazone, and canola for halosulfuron. A correlation analysis for soil herbicide dissipation and bioassay was performed for the 2004 experiment.

Halosulfuron and *s*-metolachlor dissipation was more rapid in bare-soil than soil under LDPE mulch. Sulfentrazone dissipation for bare soil was equal to soil under LDPE mulch in 2003. However, sulfentrazone dissipation in 2004 was more rapid in soil under LDPE mulch than in bare-soil. The order for half-life as defined by DT_{50} was variable for herbicide and soil exposure. Averaged across 2003 and 2004, *s*-metolachlor DT_{50} was 2 days, halosulfuron 7 days, and sulfentrazone 16 days for bare soil. Under LDPE mulch, the DT_{50} for *s*-metolachlor was 4 days, halosulfuron 10 was days, and sulfentrazone was 13 days. Correlation between quantified herbicide dissipation and bioassay for bare-soil verses soil under LDPE mulch in 2004 indicated that assay species root dry weights were negatively correlated to herbicide concentration. Data indicated that *s*-metolachlor and sulfentrazone bioassays, using oat and cotton respectively, could be utilized to assess the level of herbicide dissipation. For bare-soil and soil covered with LDPE mulch, dissipation of halosulfuron and *s*-metoloachlor were biphasic. Sulfentrazone dissipation was slower than halosulfuron or *s*-metolachlor. This indicates that sulfentrazone could provide nutsedge control when PRE applied to vegetables, but could also have the propensity for residual activity to rotational crops.