LACK OF NUTSEDGE EFFICACY IS A PROBLEM WHEN HALOSULFURON IS APPLIED THROUGH DRIP IRRIGATION

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Many proposed methyl bromide alternatives have provided sub-standard control of nutsedges. Yellow nutsedge (*Cyperus esculentus*) and purple nutsedge (*Cyperus rotundus*) are the most troublesome weeds in vegetable production in the southeast US (Webster 2006). Halosulfuron-methyl effectively controls nutsedges and is registered for use in some vegetable crops. However, lack of crop tolerance to halosulfuron in crops such as eggplant, bell pepper, and summer squash has prevented the wide-spread adoption of this effective nutsedge tool. Application of halosulfuron through drip irrigation lines may be one means to avoid crop injury. The advantage of halosulfuron as a component of a methyl bromide alternative system is that halosulfuron could target nutsedge control as alternative fumigants begin to lose efficacy. If successful, this would also provide a means of controlling nutsedges in second- and third-crop use of the same low density polyethylene (LDPE) mulch bed, situations in which the use of alternative fumigants is limited.

In the initial study, halosulfuron was applied through drip irrigation 1 to 6 days prior to transplanting eggplant on LDPE mulch. The study was conducted in 4 site-years (2 spring and 2 autumn crops). Eggplant fruit biomass was inversely related to halosulfuron rate, yield was reduced 37 to 63% at the first harvest and 39 to 49% at the second harvest (Fig. 1). There was no detectable relationship between eggplant fruit biomass and halosulfuron rate at the final harvest. However, cumulative total yield was inversely related to halosulfuron rate. More information on this study is available (Webster and Culpepper 2005).

In a related study, halosulfuron was applied at 26 g/ha through the drip irrigation at 1, 2, and 3 weeks after eggplant transplant in 4 site-years. There was a linear relationship between eggplant fruit biomass and time of halosulfuron application at the initial two harvests (Fig. 2). However, there was no effect of halosulfuron application timing at the final harvest or cumulative season total harvests. While fruit maturity was delayed by halosulfuron applied through drip irrigation, there were no season-long effects.

Cucumber tolerance to halosulfuron was evaluated over 4 site-years (2 spring crops and 2 autumn crops). Halosulfuron at 39 g/ha was applied pre-transplant through drip irrigation in all plots except for the nontreated control. Subsequent treatments included halosulfuron applied at 1, 2, and 3 weeks after transplant

(WATr) at 26 g/ha in one of two methods, postemergence-over-the-top (POST) or through drip irrigation (Drip). All treatments are expressed as percentage of the halosulfuron preemergence (with no subsequent applications) treatment (PRE). At the first two harvests, POST applications had lower cucumber fruit biomass than PRE, while all Drip treatments were equivalent to PRE (Fig. 3). All treatments in the cumulative final harvest exceeded 80% of the PRE, with no differences among PRE, Drip, and 3WATr POST. The nontreated control and POST applications at 1WATr and 2 WATr were lower than PRE at the final cumulative harvest.

Crop safety to halosulfuron was achieved with eggplant and cucumber (Figures 1-3), however these studies were conducted under weed-free conditions. Halosulfuron does have soil activity, but lateral movement from a drip irrigation system across a raised soil bed has not been evaluated. An eggplant crop was grown in study area with a moderate infestation of purple nutsedge. There were no differences in nutsedge populations prior to treatment (Table 1). There were significant changes between 3 and 5 weeks after treatment and the pretreatment densities, however overall nutsedge populations remained high in all treatments, with no detectable differences among treatments.

Additional studies were conducted in 2006 to evaluate the influence of soil pH on the lateral movement of halosulfuron from the drip irrigation line. The solubility of halosulfuron is 15 mg/L at pH 5 but increases to greater than 1630 mg/L at pH 7. Therefore, we hypothesized that halosulfuron mobility across the soil bed would be greatly increased by raising soil pH. Halosulfuron rates of 0, 26, 39, 52, and 79 g/ha were applied to plots through drip irrigation. Each plot was divided into two subplots; the first subplot in the bed had lime applied that raised the soil pH to 8.1 and the second subplot was the other half of the bed, which had a soil of 6.4. Beds were then formed and covered with black LDPE, then treated with halosulfuron through the drip irrigation system. In the autumn, the field used for the study had a moderate yellow nutsedge population. An estimation of the zone of halosulfuron movement was made in the autumn study using the naturalized yellow nutsedge population as the bioassy. The zone of yellow nutsedge control/growth suppression was greater than 30 cm around the drip irrigation line in all treatments. However, there was a weak linear relationship between the size of this zone of control and rate of halosulfuron. In contrast to the hypothesis, the zone of nutsedge control was greater (34.5 cm wide) at the non-amended soil pH (6.4) relative to the zone of control (26.8 cm) in the limed soil (pH 8.1). Halosulfuron solubility was increased with increasing soil pH, but dissipation may also have increased due to hydrolysis, thus reducing the potential for extended nutsedge control.

CONCLUSIONS

Injury to eggplant and cucumber from halosulfuron was minimized by application through drip irrigation lines following transplant.

Halosulfuron applied through drip irrigation lines did not provide effective nutsedge control. Attempts to improve lateral movement through manipulation of the soil pH were inconsistent and even contrary to what was predicted. By raising the soil pH, halosulfuron dissipation may also have been accelerated which resulted in decreased residual control for nutsedge. While a promising idea for managing nutsedge populations in crops sensitive to topical-over-the-top applications of halosulfuron, it does not appear that application through drip irrigation will be a viable methyl bromide alternative for nutsedge management.

Literature Cited

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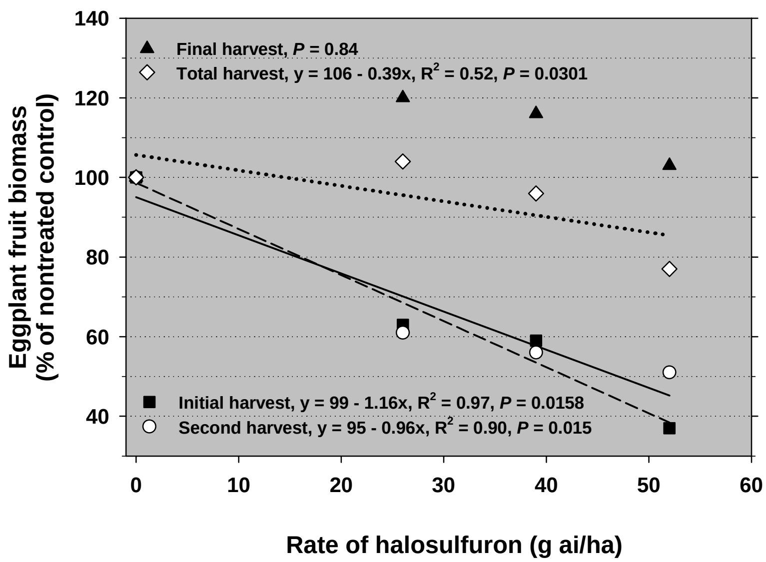

Figure 1. The influence of halosulfuron rates applied through drip irrigation on eggplant fruit yield.

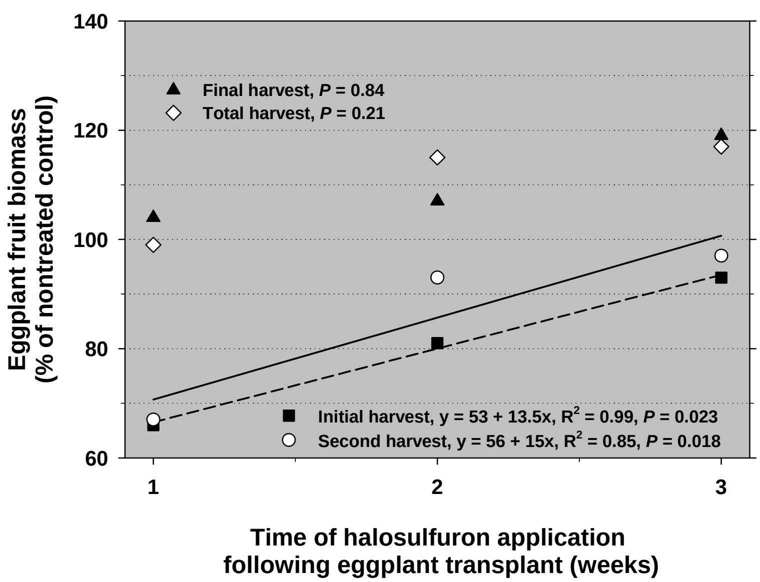

Figure 2. The influence of timing following eggplant transplant of halosulfuron applied through drip irrigation on fruit yield.

Figure 3. The influence of halosulfuron applied through drip irrigation on cucumber fruit yield

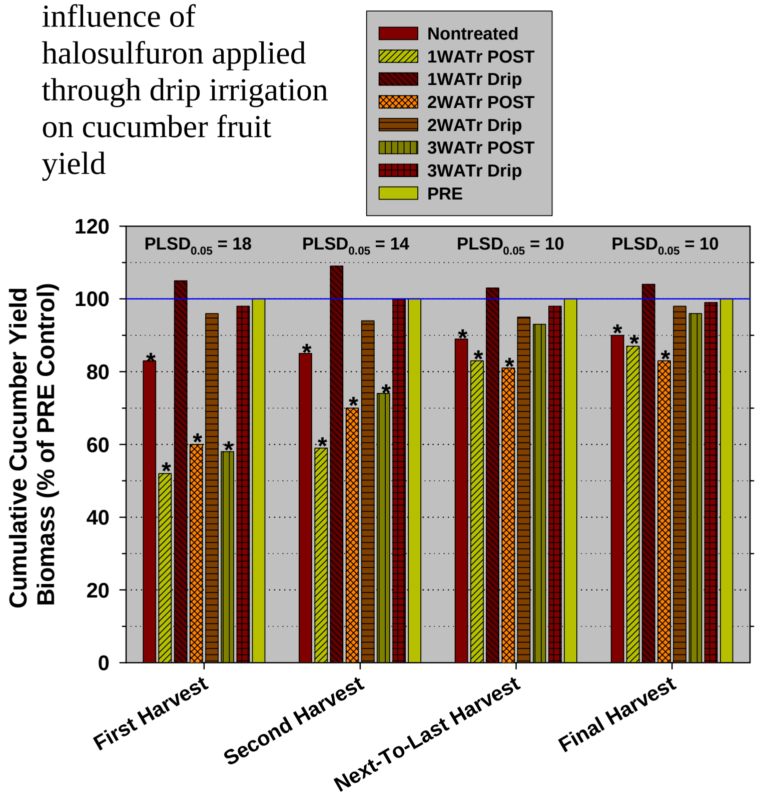

Table 1. The influence of halosulfuron applied through drip irrigation at various rates and timings following eggplant transplant on nutsedge shoot populations.

Halosulfuron Applications (Timing)	Pre-treatment	3 Wks After Transplant		5 Wks After Transplant		7 Wks After Transplant	
g ai/ha	#/m^2	#/m^2	% Change[A]	#/m^2	% Change[A]	Center 30cm	Total
Nontreated	44	76	71% BC	100	128% BC	37	89
26 (1 Wk) +26 (3 Wk)	54	80	55% C	95	83% CD	23	73
52 (1 Wk)	40	66	68% BC	80	101% BCD	17	59
79 (1 Wk) +79 (3 Wk)	55	82	52% C	86	63% D	19	56
26 (2 Wk) +26 (4Wk)	37	75	101% A	106	188% A	22	81
52 (2 Wk)	36	69	91% AB	90	148% AB	23	67
PLSD0.05	NS	NS	27%	NS	60%	NS	NS
P-value	0.5810	0.92	0.0125	0.528	0.0091	0.1776	0.221

[A] % Change is the change in nutsedge density between 3 or 5 weeks after transplant and the pretreatment density.