

Crop tolerance to preemergence herbicides applied under plastic mulch within a strawberry-vegetable relay cropping system

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Summary

Crop tolerance to preemergence herbicides applied under the plastic mulch was tested within a strawberry-vegetable relay cropping system. Berry yields were unaffected by any of the preemergence herbicides. Fierce is of particular interest due to its known efficacy on a wide spectrum of weed species. Herbicides were safe on relay cropped vegetables although low-level eggplant damage occurred where Chateau, Dual Magnum or Fierce was applied.

Methods

Experiments were conducted in the winter of 2019 to evaluate strawberry tolerance to numerous herbicides applied pre-transplant in Florida strawberry at the Gulf Coast Research and Education Center (27°N, 82°W) in Balm, FL. Soils at the site are a Myakka fine sand (Sandy, Siliceous Hyperthermic Oxyaquic Alorthod) with a pH of 6.8, 0.8% organic matter and 98, 1, and 1 % sand, silt, and clay, respectively. The field used in this experiment has a history of purple nutsedge infestation.

All experiments were arranged as a randomized complete block design with four blocks. Each plot consisted of 25 feet of a single raised bed. There was 4 feet between beds and each bed had a height of 12 inches, base width of 32 inches and a bed-top width of 28 inches. Raised beds were formed with standard bed-pressing equipment and the soil was fumigated with 300 lbs/acre of Telone C-35 on August 26, 2019. A single drip tape with emitters every foot and a flow rate of 0.95 L min⁻¹ per 30.5 m (Jain Irrigation Inc., Haines City, FL) was installed in the center of the bed

and the beds were covered with TIF plastic mulch (Berry Plastics Crop, Evansville, IN).

Herbicide treatments and application rates are listed in Table 1. All herbicides were applied to the bed top immediately prior to laying the plastic mulch. All herbicide treatments were applied in 20 gallons/acre of water with a backpack sprayer (Bellspray Inc., Opelousa, LA) equipped with a single 8002EVS nozzle (Teejet Technologies, Wheaton, IL) at a pressure of 0.24 MPa. It is important to note that the treatment list included Dual Magnum and Fierce, both of which are not registered for use in strawberry in Florida.

Two rows of strawberry (cultivar Florida Brilliance) were transplanted per bed with 15 inch spacing between plants on October 8, 2019. Cantaloupe (cultivar Athena) and eggplant (cultivar Nightshadow) were transplanted in the center of the bed as close to the drip tape as was safely possible with 30 inch spacing on February 2 and 5, 2020, respectively. Banana peppers (cultivar Giant Superette) were transplanted on February 5, 2020, in the center of the bed as close to the drip tape as was safely possible with 15 inch spacing. All plots were irrigated and fertilized throughout the growing season as per industry standards (Vallad et al. 2014).

The number of purple nutsedge shoots that punctured the TIF mulch was counted within the planted area (15 feet of the bed) on December 13, 2019. Strawberry damage where 0 is no injury and 100 represents complete desiccation was visually evaluated on October 14, October 22 and October

29, 2019. Vegetable damage where 0 is no injury and 100 represents complete desiccation was visually evaluated on February 20, March 5, March 18 and April 2, 2019. Strawberries were harvested and weighed biweekly from December 19, 2019 through February 25, 2020. Vegetables were not harvested due to the Covid-19 shutdown.

Data were analyzed in SAS using the Mixed procedure. Block was considered a random variable. Means were compared using the least square means statement in SAS, specifying for Tukey's honest significant difference. Model assumptions of normality and constant variance were checked.

Results

Impact of herbicides on strawberry growth and yield

None of the herbicides had any impact on strawberry growth or yield (Table 2). This research identified three non-registered herbicides (Eptam, Dual Magnum, and Fierce) that appear to be safe for use in strawberry and additional research is needed to pursue registration. We cannot pursue Eptam further as the company will not support registration. Fierce is interesting because it is very effective on both broadleaf and grass weeds and is very persistent in the soil. No damage was observed with Dual Magnum, but in other trials we have found that this product can cause minor crop damage.

Impact of herbicides on vegetable growth and yield

None of the herbicides caused consistent cantaloupe damage (Table 3). Chateau, Dual Magnum and Fierce caused minor eggplant damage that had disappeared by mid-March. None of the herbicides caused

consistent pepper damage. It is important to note that some of the damage observed in the plots was due to insects and wind.

Conclusions

Our results indicate that when Chateau, Goal 2XL, Goal 2XL+Devrinaol 2-XT, Spartan FL 4F and Dual Magnum, Eptam and Fierce were applied under the plastic mulch prior to strawberry transplant they had no impact on strawberry yield. We have also shown that none of the herbicides damaged relay cropped cantaloupe or pepper, but low-level eggplant damage occurred where Chateau, Dual Magnum or Fierce were applied. We recommend additional research be conducted to support the registration of Fierce in strawberry.

Disclaimer

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Table 1. Herbicide treatments applied preemergence under the plastic mulch at GCREC in 2018.

Trade name	Active Ingredient	Rate
Nontreated	-	-
Chateau	flumioxazin	3 oz/acre
Goal 2XL	oxyfluorfen	1 pint/acre
Goal 2XL + Devrinol 2-XT	oxyfluorfen + napropamide	1 pint/acre + 1 gallon/acre
Spartan FL 4F	sulfentrazone	4 oz/acre
Dual Magnum	S-metolachlor	1 pint/acre
Eptam	EPTC	0.5 gallons/acre
Fierce	Flumicazin + pyroxasulfone	3 oz/acre
Fierce	Flumicazin + pyroxasulfone	6 oz/acre

Table 2. Effect of preemergence herbicides on total berry yield in 2019 at GCREC.

Herbicide	Cantaloupe trial	Eggplant trial	Pepper Trial
	-----lb/acre-----		
Nontreated	12,218	9,825	10,746
Chateau	12,295	9,746	9,568
Goal 2XL	9,607	9,172	7,181
Goal 2XL + Devrinol 2-XT	11,075	8,124	8,932
Spartan FL 4F	13,535	8,252	7,596
Dual Magnum	11,140	9,280	7,017
Eptam	12,441	9,547	10,664
Fierce 1X	11,690	10,406	7,824
Fierce 2X	12,774	8,033	9,470
P value	0.7035	0.4792	0.1801

Table 3. Effect of preemergence herbicides applied prior to strawberry transplant on the following vegetable crop in 2019 at GCREC.

Herbicide	Cantaloupe	Eggplant	Pepper
	-----%-----		
Nontreated	0	0 c ¹	0 d
Chateau	2	12 ab	3 bcd
Goal 2XL	7	2 bc	5 a-d
Goal 2XL + Devrinol 2-XT	0	7 abc	5 a-d
Spartan FL 4F	12	7 abc	5 a-d
Dual Magnum	1	14 a	6 abc
Eptam	2	7 abc	7 ab
Fierce 1X	12	12 ab	9 a
Fierce 2X	8	16 a	2 cd
P value	0.2241	0.0373	0.0170

¹Means within columns followed by the same letter are significantly different based on Tukey adjusted means comparisons at p<0.05.