Stevia (*Stevia rebaudiana*) Tolerance to Herbicides Applied Post-Transplant

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Introduction

Stevia production is an emerging industry in the US.[1] Stevia is valuable as a zero-calorie sugar substitute 300 times sweeter than sugar.[2] It is also valuable as a rotational crop for growers. Stevia can be grown in the same climate as tobacco and does not require the purchase of new equipment for transplanting and drying.[3] Stevia growth is initially slow making it sensitive to weed interference, particularly early in the season.[3] However, few herbicides are registered for use in stevia, especially post-transplant.

Objectives

To determine the effect of herbicides applied after transplanting on stevia growth and yield.

Hypothesis

Herbicide treatments will not reduce stevia yield.

Materials and Methods

- Field study was conducted in Clinton, NC in 2021.
- Stevia plants were transplanted into bareground with 0.15 m in row spacing and 1.5 m spacing between rows.
  - 3 m long plots.
- Study design was RCB with 4 replications.

Treatments:

- Linuron (560 g ai ha^{-1}), fomesafen (340 g ai ha^{-1}), acifluorfen (340 g ai ha^{-1}), halosulfuron (26 g ai ha^{-1}), *S*-metolachlor (800 g ai ha^{-1}).
  - Halosulfuron and *S*-metolachlor were applied over-the-top of stevia 3 wk after transplanting (WAT).
  - Linuron, fomesafen, acifluorfen were applied directed to the lower third (Figure 1) of the plants 3 WAT.

Application equipment: CO_2-pressurized backpack sprayer calibrated to deliver 187 l ha^{-1} at 200 kpa.

- DG 8003VS nozzles

Data collected:

- Visual injury at 2 and 6 WAT.
- Visual Palmer amaranth control 2 WAT.
- Total stevia yield at 110 d after transplanting (DAT).
- Data was analyzed with SAS (Version 9.4 PROC MIXED).

Figure 1. Directed application to the bottom third of the stevia plants.

Treatment	Injury		Stunt	Yield	AMAPA Control
	2 WAT	6 WAT	6 WAT	Kg ha^{-1}	%
Nontreated	0	0	0	2127 ab	-----
Linuron	1 c	0	0	2806 a	98 a
Halosulfuron	16 a	2 b	10a	2070 ab	87 ab
***S*-metolachlor**	1 c	0	0	2712 ab	74 b
Fomesafen	4 b	45 a	1 b	1878 b	99 a
Acifluorfen	1 c	0	0	2589 ab	97 a

Figure 2. Effect of herbicides on stevia injury, stunting, yield, and Palmer amaranth control in Clinton, NC 2021.

Figure 3. (A) nontreated check (B) linuron (C) acifluorfen (D) *S*-metolachlor (E) halosulfuron (F) fomesafen.

Results

- Injury from the majority of the treatments was minimal (5%) [Figure 2] except halosulfuron (16%).
- By 6 WAT, with the exception of fomesafen (45%), there was minimal stunting (< 10%) and injury from the rest of the treatments.
- Stevia yield was not significantly reduced by any of the treatments in comparison to the nontreated; however, fomesafen caused injury which would impact the stevia quality beyond an acceptable level.
  - Injury from fomesafen included bronzing which became worse throughout the season after each rain event.
  - Palmer amaranth control from acifluorfen, fomesafen, and linuron was at least 97%. Control from halosulfuron was 87%.

Conclusions

Linuron, halosulfuron and acifluorfen are not registered for use in stevia post-transplant and may provide novel modes of action that may aid in herbicide resistance management. Based on these results, linuron, halosulfuron and acifluorfen are good candidates for registration through the IR-4 Project.

Future Research

With only one year of data, the study requires replication. In addition, stevia is a perennial. As a result, research is required to quantify the effect of these treatments on stevia's ability to overwinter. Additionally, it would be beneficial to examine stevia's tolerance to these treatments with sequential applications throughout the season.

Literature Cited

[1] Cavaliere C (2009) FDA accepts safety of two stevia preparations for food and beverage use. Herbal Gram 81:67-69

[2] Lester T (1999) Stevia rebaudiana. Sweet leaf. Aust New Crop Newsletter. 11:1

[3] Chriest K (2019) S-metolochlor Registration Improves Weed Management for Stevia. https://www.ir4project.org/fc/s-metolachlor-stevia-weeds-2019/ Accessed: February 11, 2023

[4] Webster TM (2010) Weed survey – southern states: vegetable, fruit, and nut subsection. Page 246-257 *in* Proceedings of the Southern Weed Science Society. Westminster, CO: Southern Weed Science Society

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