Critical Timing of Palmer Amaranth (*Amaranthus palmeri*) Removal in Stevia (*Stevia rebaudiana*)

SJ Ippolito, KM Jennings, DW Monks, S Chaudhari, DL Jordan, LD Moore, CD Blankenship, KC Sims, C Lnu
Department of Horticultural Science, North Carolina State University

Introduction

Stevia is a zero-calorie sweetener, 300 times sweeter than sucrose.[1] As a result, it serves as an excellent sugar substitute, especially for diabetics. Palmer amaranth is well noted for its competitive nature.[2] In other specialty crops, such as sweetpotato, shading from Palmer amaranth can cause significant yield loss.[3] Prior research has shown the critical timing for weed removal to be at 1 wk after transplanting (WAT).[4] Further knowledge of how Palmer amaranth competes with stevia may help growers implement the necessary weed control actions.

Objectives

Determine critical timing for Palmer amaranth removal.

Hypothesis

The critical timing for Palmer amaranth removal will be similar to that observed in a greenhouse setting.

Materials and Methods

- A field study was conducted in Clinton, NC in 2021.
- Stevia transplants were planted at a density of 6.5 m^{-1} of row on raised beds covered in white polyethylene mulch.
- **Treatments:** Palmer amaranth removed at 0, 3, 5, 7, 9, 1 1 WAT.
- RCBD replicated four times.
- Palmer amaranth density was established from a natural population.
- **Data collected:**
  - Palmer amaranth shoot dry biomass per 3.1 m of row.
  - Stevia height and internode length at time of Palmer amaranth removal.
  - Total stevia yield at 110 d after transplanting (DAT).
- Data analyzed with SAS (version 9.4) PROC MIXED, PROC NLIN, PROC COR, and PROC REG.

Literature Cited
[1]Lester T (1999) Stevia rebaudiana. Sweet leaf. Aust New Crop Newsletter. 11:1
[2]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
[3]Meyers SL, Jennings KM, Schultheis JR, Monks DW (2010) Interference of Palmer amaranth (*Amaranthus palmeri*) in sweetpotato. Weed Sci 58:199–203
[4]Azimah AK, Ismail BS, Juraimi AS (2018) Critical period of weed control in *Stevia rebaudiana* (Bert.) Bertoni. J Trop Agric and Fd Sc 46:91– 98
[5]Smith SC, Jennings KM, Monks DW, Chaudhari S, Schultheis JR, Reberg-Horton C (2020) Critical timing of Palmer amaranth (*Amaranthus palmeri*) removal in sweetpotato. Weed Technol 34:547-551

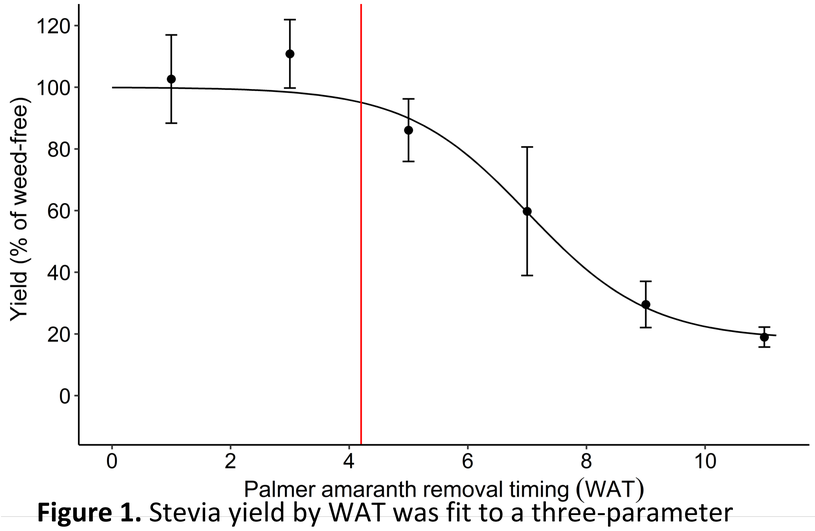

Figure 1. Stevia yield by WAT was fit to a three-parameter logistic model, at 4.2 wk (red line) yield was reduced to 95%; R^2 = 0.97; P = <0.0001.

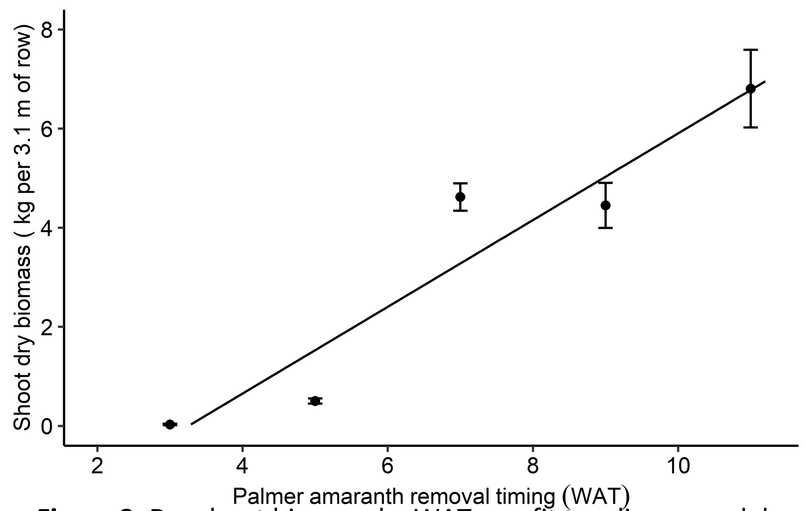

Figure 2. Dry shoot biomass by WAT was fit to a linear model; R^2 = 0.90; P = 0.013.

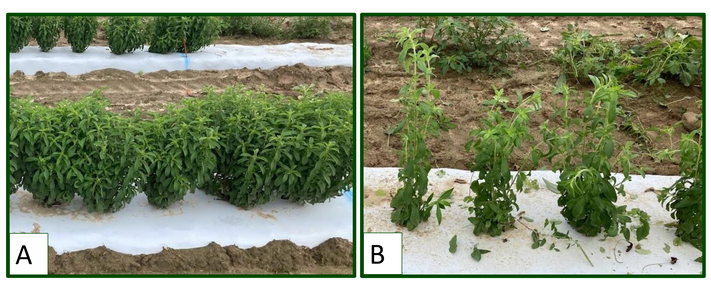

Figure 3. (A) Stevia weed-free all season. (B) Stevia after Palmer amaranth removed 9 WAT.

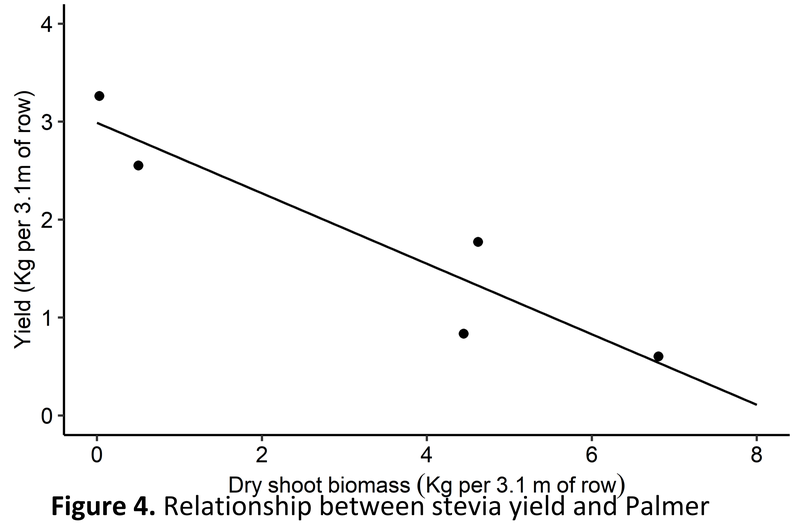

Figure 4. Relationship between stevia yield and Palmer amaranth dry shoot biomass fit to a linear model; Y=-0.36x+3; R^2 = 0.87; P = 0.02. Pearson coefficient=-0.91

Results

- Predicted stevia yield was 95 and 19% at 4.2 and 11 WAT, respectively (Figure 1) .
- Delaying Palmer amaranth removal increased Palmer amaranth dry shoot biomass (Figure 2).
- There is an inverse relationship between Palmer amaranth dry shoot biomass and stevia yield (Figure 4).

Conclusions

- Stevia yield can be severely reduced by interference from Palmer amaranth, with yield decreasing as Palmer amaranth removal is delayed.
- At 4.2 WAT stevia yield reached the 5% yield loss threshold, later than in other specialty crops such as sweetpotato[5] and later than reported by Azimah et al. (2018).

Future Research

The relationship between Palmer amaranth dry shoot biomass and stevia biomass (yield) was tightly correlated. After late season Palmer amaranth removal, stevia demonstrated shade avoidance responses (Figure 3). Future research should focus on further characterization of how Palmer amaranth competes for resources such as light with stevia.

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