INFLUENCE OF SEED SIZE ON COTTON INJURY FROM SOIL APPLIED HERBICIDES AT PLANTING

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Introduction

- Preemergence herbicides (PREs) are a critical component of weed management in cotton, especially with the prevalence of glyphosate-resistant Palmer amaranth (\textit{Amaranthus palmeri} S. Wats).
- The challenge in using PREs is the potential injury to seedling cotton that can be attributed to these soil-applied herbicides.
- Many factors influence seedling growth and the interaction with soil-applied herbicides, including environment, seed vigor, herbicides rates, and seeding depth.
- Previous research has indicated that a larger seed size has more vigor and can compensate for early season stress(s) under certain circumstances (Snider et al., 2014 and Collins, 2016).
- As seed and other input costs continue to rise, more information on seed size, seeding vigor, and PRE herbicide injury potential is needed so that growers can make informed decisions for their individual operations.
- Hypothesis: The larger seeded variety will have higher seeding vigor, resulting in less herbicide potential injury during the early stages of plant development.
- Objective: To evaluate the effects of seed size on the overall growth, development, and yield of cotton in response to PRE herbicides.

Materials and Methods

- **Trial Years:** 2021 & 2022
- **Locations:** The Pee Dee Research and Education Center in Florence, SC, the Edisto Research and Education Center in Blackville, SC.
- **Two Seed Sizes:** Large (NG 4098B3XF/1950 seed/kg) and Small (DP 2038B3XF/2676 seed/kg)
- **Planting Date and Seeding Rate:** Florence- May 10, 2021 and May 11, 2022; Blackville- May 11, 2021 and May 18, 2022 at a seeding rate of 22k seed/ha.
- **Plots:** 4-row plots by 12.2m in length on 96.5cm row spacing.
- **Experimental Design:** Split Plot with 4 replications; Main plot: Seed Size, Sub-plot: Herbicide Treatment.
- **Herbicide PRE Treatments:** Reflex (2.2 kg/ha), Direx (3.4 kg/ha), and Warrant (6.7 kg/ha) alone and in combination for each seed size. An untreated check was included for each seed size.
- **Data Collection:** Visual injury ratings at emergence, 14, 21, 28, and 42 Days After Planting (DAP), fresh and dry biomass weights at the 3-leaf stage, plant heights at 28 and 42 DAP, stand counts at 14 and 28 DAP, percent lint and fiber quality.
- **Data Analysis:** All data were analyzed using Analysis of Variance (ANOVA). Means were separated using Fisher’s LSD at the 0.05 level of probability.

Results

- When averaged over years and seed size, the Reflex + Direx and Direx (alone) treated plots showed the most visual injury at 21 (p < 0.0001) and 28 DAP (p < 0.0001) in Florence (Figure 1).
- As expected, the non-treated plots had the highest dry biomass weight at the 3-leaf stage at both locations and showed no signs of injury in both years (Figures 1 and 2).
- When averaged across years and herbicide treatments, the large-seeded variety had significantly higher dry biomass weight at the 3-leaf stage in both Florence and Blackville (Figure 3).
- The large-seeded variety's stand counts were also higher (p = 0.0596) at 14 DAP in Florence when averaged over years and herbicide treatment (data not shown).
- No visual injury was observed prior to 21 DAP in Florence or Blackville in both years, but injury symptoms began appearing earlier (around 14 DAP) in Florence in 2022.
- Visual injury gradually decreased from 21 DAP to 42 DAP, with injury symptoms peaking at 21 DAP in both Florence and Blackville in both years (Figure 4).
- Injury from the herbicide treatments including Warrant were mostly seen in the form of reduced stands.
- There were no significant seed size x herbicide interactions in either year for dry biomass in the 3-leaf stage (p = 0.1037) or for lint yield in Florence (p=0.4204) or Blackville (p=0.9106).
- The large-seeded variety fibers were longer, stronger, finer and more uniform (p < 0.0001) than the small-seeded variety when averaged across herbicide treatments in Florence in both years (data not shown).
- In both years and locations, the small-seeded variety produced significantly higher lint yield than the large (1973 lb./ac compared to 1625 lb./ac in Blackville; 1580 lb./ac compared to 1240 lb./ac in Florence when averaged over years) (Figure 5).

Discussion & Conclusions

- In both years, the large-seeded variety had a higher dry weight at 3f stage which could indicate vigor was less impacted by the PRE herbicide injury.
- However, at 42 DAP, both varieties appeared to “grow out” of the herbicide injury and the larger seed did not contribute to higher lint yield than the small seeded variety.
- This is consistent with research conducted in the Mid-South where cotton withstood up to 41% injury without affecting final lint yield (Samples et al., 2021).
- Previous research has also shown that bolls containing smaller seeds typically have more seeds per boll, and that having additional seeds in the boll creates more surface area for lint production (Culp and Harrell 1975).
- Results from this study will provide cotton growers of SC and May 11, 2022, Blackville with additional information on seed size and lint yield.
- Future research: Repeat this study with multiple different seed sizes (extra-small to extra-large) to determine a positive trend with seedling vigor, as well as obtaining oil and protein content from seed prior to planting as previous research has indicated that oil and protein content are also predictors of seedling vigor (Snider 2016).

References


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Please feel free to reach out with any questions!

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