Evaluation of Residual Herbicides Coated on Granular Fertilizer in Cotton

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Introduction and Research Justification

- Palmer amaranth *(Amaranthus palmeri)* has evolved resistance to 9 herbicide MOAs (Heap, 2022)
- Therefore, it's critical to determine if additional modes of action can be integrated into cotton weed management
- Herbicide coated on granular ammonium sulfate (AMS) fertilizer provides an alternative to post-directed applications, the potential to use additional MOAs, and a timelier way to get a residual on cotton with minimal injury (Steckel, 2021)

Objective

- Evaluate residual herbicides coated on AMS in cotton

Hypotheses

- 1) Residual herbicides coated on AMS will not injure cotton and 2) will provide good control of Palmer amaranth

Materials and Methods

- **Two Locations:** Clayton and Rocky Mount, NC
  - Clayton: Dothan Loamy Sand soil
  - Rocky Mount: Aycock Very Fine Sandy Loam soil
- **Cotton Variety:** DP 2115 'B3XF'
- **Planting Date:** 11 May 2022
- **Experimental Design:** RCBD with four replications
- **Treatments:** 16 treatments including a check **(Figure 1)**
  - All treatments were coated on 286 lbs. AMS/A and top-dressed on 6- to 7- leaf cotton on 17 June 2022
  - The check received the equivalent rate of AMS
  - Prior to top-dress, plots were kept weed free with glyphosate and glufosinate
  - Total amount of solution for each treatment was 45ml, which included herbicide, blue dye (1ml), and water
- **Mixing and Top-dress:** The solution was dispensed into a concrete mixer with AMS and tumbled to ensure thorough coverage. Plastic containers were used as shakers to evenly broadcast coated AMS throughout an entire plot **(Figure 2)**
  - Both locations received 0.4 in of activating rainfall by 8 DAT
- **Data Collection:** Visual estimates bi-weekly for cotton injury and Palmer amaranth control for up-to 70 days after treatment (DAT)
  - Late season Palmer amaranth density and biomass
  - Cotton was machine harvested and weighed for yield
- **Statistical Analysis:** All data was subjected to ANOVA using Proc GLM in SAS 9.4
  - A significant location by treatment interaction warranted analyzing cotton injury data by location **(Figure 5)**
  - Palmer amaranth control data was pooled over locations

Figure 1: Herbicide treatments and rate

Herbicide	Rate (g ai ha^{-1})	Rate (oz/A)
check	NA	NA
pyroxasulfone	119	3.25
pyrox + carfen	127	3.63
S-metolachlor	1,067	16
dimethenamid-*P*	630	12
acetochlor	1,260	48
pendimethalin	1,064	32
fomesafen	280	16
flumioxazin	52	1.5
sulfentrazone	210	6
fluridone	221	21
diuron	840	24
fluometuron	1,120	32
linuron	840	24
atrazine	1,120	32
metribuzin	420	8

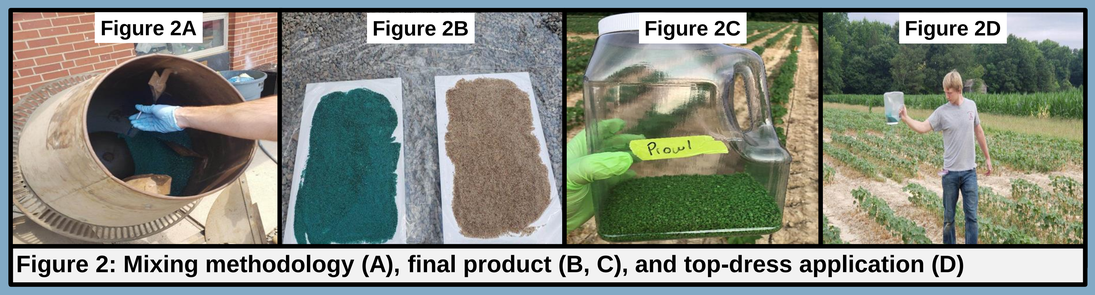
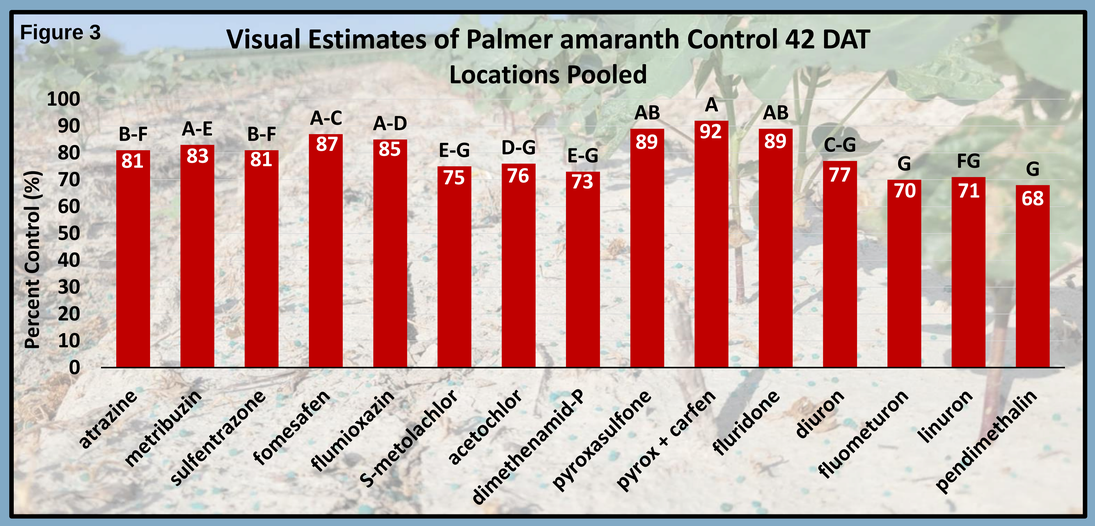
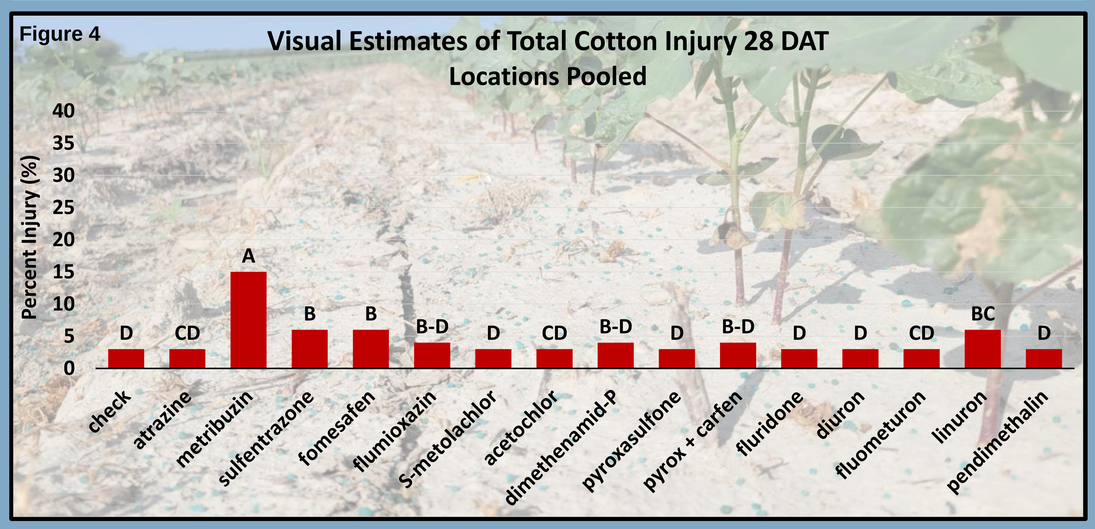
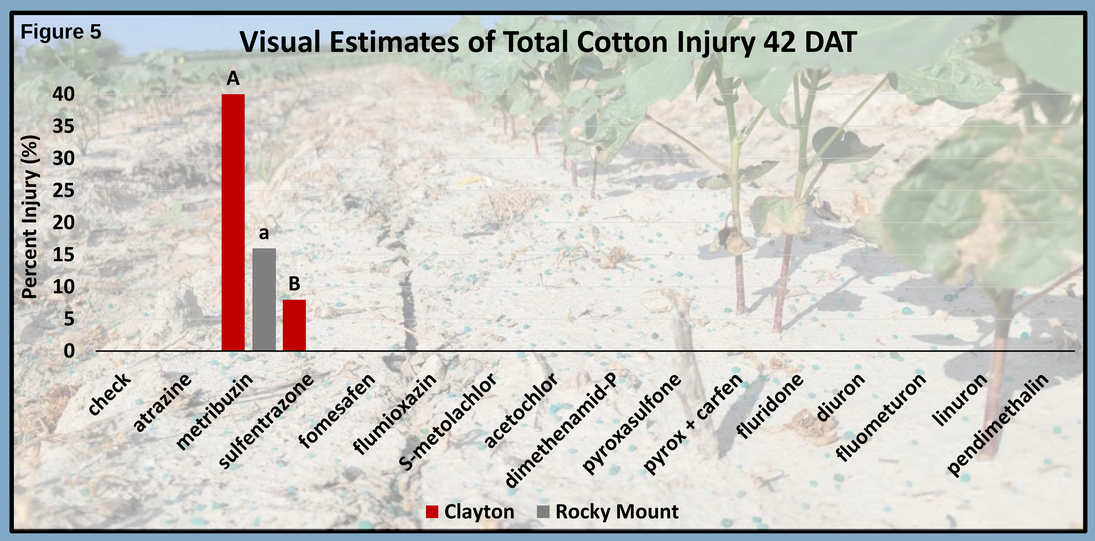


Figure 2: Mixing methodology (A), final product (B, C), and top-dress application (D)







Literature Cited

- Heap, I. The International Herbicide-Resistant Weed Database. Online. Thursday, December 15, 2022 . Available www.weedscience.org
- Steckel, L. (2021, June 21). Zidua Impregnated on Fertilizer Applications in Cotton. https://news.utcrops.com/2021/06/zidua-impregnated-on-fertilizer-applications-in-cotton/
- Everman, W. J. and Jones E.A.L. (2021, January 11). PSI & II-Inhibiting Herbicide Injury on Soybean. North Carolina Cooperative Extension. http://bit.ly/3HQXU0s

Results and Discussion

- **Cotton Injury:** Top-dress - 28 DAT
  - Foliar necrosis was the primary injury observed
  - During the early season, sulfentrazone was the most injurious with 19% total cotton injury (Data not presented)
  - By 28 DAT, most treatments resulted in injury similar to the check, except for metribuzin, sulfentrazone, fomesafen, and linuron **(Figures 4 and 6)**
  - Some foliar injury may have resulted from damp foliage at the time of top-dress (Steckel, 2021)
- **Cotton Injury:** 42 DAT
  - Both foliar necrosis and chlorosis were observed
  - By 42 DAT, early season cotton injury was transient except for metribuzin and sulfentrazone **(Figure 5)**
  - Metribuzin injury was variable and significantly different by location, with 40 and 15% injury at Clayton and Rocky Mount, respectively **(Figures 5 and 7)**
  - A Coarser soil at Clayton could explain the variability in metribuzin injury (Everman and Jones, 2021)
- **Palmer amaranth Control:** 42 DAT
  - Pyroxasulfone was most effective among group 15 herbicides with 89% control **(Figure 3)**
  - Pyroxasulfone, pyroxasulfone + carfentrazone, fluridone, metribuzin, fomesafen, and flumioxazin all resulted in similar control
  - Overall, treatments performed as expected
- **Cotton Yield:** Data not presented
  - No statistical difference in cotton yield was observed

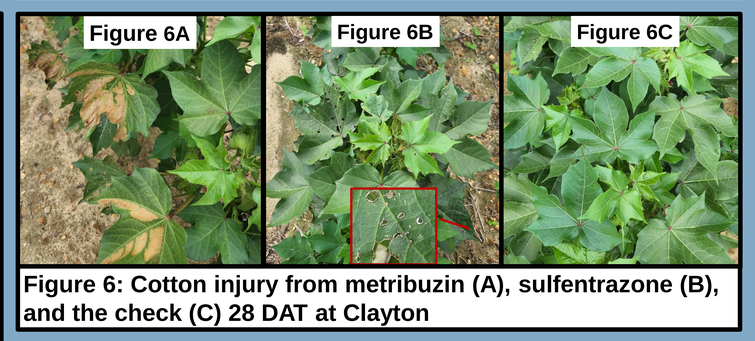


Figure 6: Cotton injury from metribuzin (A), sulfentrazone (B), and the check (C) 28 DAT at Clayton

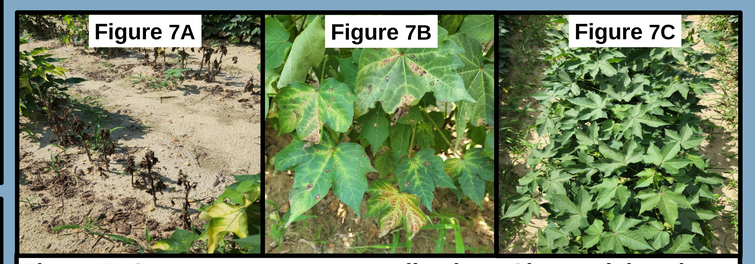


Figure 7: Cotton response to metribuzin at Clayton (A) and Rocky Mount (B) relative to a check (C), 42 DAT

Conclusions and Significance to NC Agriculture

- **Hypothesis (1):** Fail to reject the null; AMS coated with residual herbicide did in fact injure cotton
- **Hypothesis (2):** Reject the null; AMS coated with residual herbicide did in fact provide control of Palmer amaranth
- Although yield was unaffected, the use of metribuzin via coated fertilizer still poses a risk to cotton growers
- This method is a dual application of fertilizer and a residual, saving cotton growers money and time
- Additionally, herbicide-coated fertilizer won't tie-up a sprayer, resulting in timelier post-emergent pesticide applications

Future Research

- Repeat in 2023
- Evaluate the optimum fertilizer rate and top-dress timing for pyroxasulfone-coated fertilizer
- Evaluate the timing between top-dress and activating rainfall

Acknowledgements

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