Efficacy of Recovery Sprays to Auxin Injury

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Abstract

Auxin resistant traits in cotton have become widely embraced across the Cotton Belt for management of glyphosate resistant and other troublesome weeds. With this new adoption, off target movement and spray tank contamination has become a major concern for growers, especially in South and East Texas where both XtendFlex and Enlist Cotton have significant market share. The objective of this project is to identify the efficacy of recovery sprays from induced injury of dicamba and 2,4-D. A Dicamba rate of 1.28 fl.oz/ac and 2,4-D at 0.08 fl.oz/ac were applied separately at first bloom stage of variety FM 1953 GLTP over the center two rows with a hand boom. Seven days later, numerous plant growth regulators, various nutritional and hormonal chemistries were applied with a four row hand boom. Visual auxin injury ratings were conducted two weeks after application spray of the recovery treatments and again one week prior to application of harvest aids to assess both the amount of injury and recovery. Plant height, nodes, maturity, and planting mapping were conducted on five plants from each plot to identify exact vegetative and reproductive physiological impacts of the various treatments. Plots were mechanically harvested and fiber will be analyzed with HVI. Visual ratings of the dicamba portion resulted in less overall foliage injury but had more stunting than the 2,4-D treatments. There was no significant yield differences amongst the dicamba treatments, however the 2,4-D treatments did show more variation between treatments. The dicamba treatments had an average higher yield than 2,4-D.

Introduction

Since the release of the auxin resistant seed traits in cotton, their market share has grown to over 65% in Texas. Average yield loss from the simulated auxin injury research resulted in a yield reduction of 24%, with the 2,4-D injury being 10% greater than the dicamba injury. With more and more acres switching to the auxin resistant traits, the occurrence of off-site movement and tank contamination has risen accordingly. Herbicide off-site movement results in physiology injury of cotton plants which leads to a yield and economic loss for the cotton producer. If a product(s) can be identified to reduce herbicidal injury and yield loss, the producers will be able to recoup economic losses.

Objective

Evaluate commercial available products for their effectiveness of recovering cotton plants from auxin injury.

Materials and Methods

At first bloom, June 26th, dicamba and 2,4-D were applied separately at 1.28 (1/10th) and 0.08 (1/200th) fl.oz/ac rates, respectively, to mimic off-site and tank contamination scenarios. Over each of the injury induced fields, eight different products were applied, plant growth regulators, nutritionals and hormonal sprays. One week after the injury induced applications, all recovery treatments were applied to create a two row by 40 ft. plots with four replicates. Each trial had an untreated check (no auxin), auxin spray only, and then eight recovery treatments (Table 1).

Visual observations were made 14 days and 75 days (7 days prior to harvest aid application) after the recovery spray application. Following the harvest aid applications, five consecutive plants were removed from each plot for plant mapping. Plant mapping included the quantification of fruit position, internode length, heights, and node counts. Plots were harvested on September 27 with a 2 row spindle picker. Plot weights were recorded and subsamples obtained for fiber analysis. The cotton was ginned and fiber quality was quantified by HVI.

Figure 1 - Yield Response by Treatment Numbers

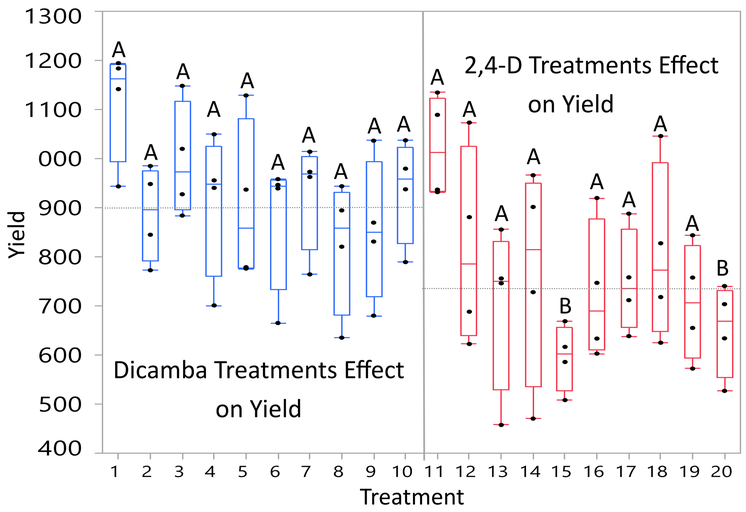


Table 1: Treatment Numbers by Brand Name, Common Name, and Analysis

Treatment No.		Product Names	Rate (FL OZ/AC)
Dicamba	2,4-D		
1	11	Untreated Check	
2	12	Auxin Herbicide	1.28, 0.08
3	13	Mepiquat Chloride	18
4	14	Pentia (Mepiquat Pentaborate)	24
5	15	Palisade (Trinexapac-ethyl)	23
6	16	Megafol (3-0-8)	24
7	17	Radiate (IBA & Kinetin)	5
8	18	CoRoN (10-0-10-.5B)	128
9	19	Finish-Line (8-4-6-.1B-.2Cu-1Mn-1Zn)	32
10	20	N-Demand 88 (10-8-8-2S-.25B-.06Cu-.25Mn-.25Zn)+ Advantigro (Kinetin, IBA, GA)	64 4

Figure 2

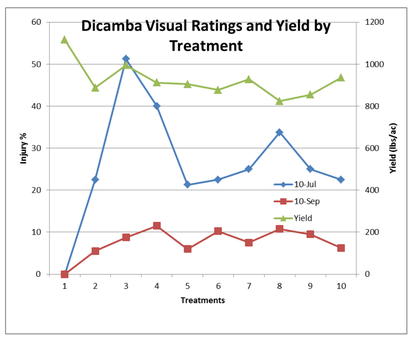


Figure 3

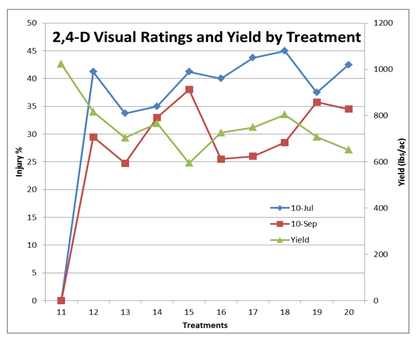
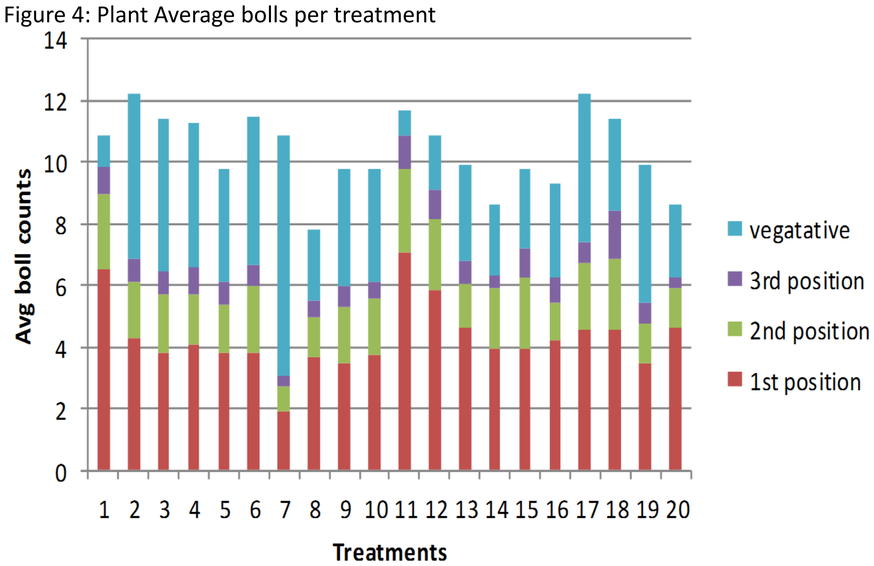


Figure 4: Plant Average bolls per treatment



Results

Visual injury ratings were higher for both treatments 14 days after the injury induced spray than the pre-harvest aid visual ratings for both auxin herbicides. Dicamba treatments recovered and retained more foliage than the 2,4-D treatments and had a lower height:node ratio. Only a statistical yield differences (P=0.05) observed between the untreated and treatments 15 and 20 for 2,4-D; there was a large numerical difference observed. Aggregating both scenarios, over a 24% yield loss occurred despite the 2,4-D being applied at a 20X lower rate compared to dicamba. Despite both dicamba and 2,4-D being auxin herbicides different yield responses were observed between the recovery treatments. Based on these results, the cotton plant physiologically processes these synthetic auxin molecule differently. The top yielding responses for dicamba were treatment 3, 7, and 10 while it was treatments 14, 17 and 18 for 2,4-D, with only the Radiate treatment (7&17) performing similarly for both auxins (Figure 1). Interestingly, the 2,4-D alone treatment resulted in the second highest yield compared to the untreated.

The higher dicamba yield average was expected, as the pre-harvest aid visual rating drastically improved from the 14 days after application ratings (Figure 3). The lower 2,4-D yield was due to the greater affect 2,4-D had on the foliage, shown by the visual injury ratings (Figure 3), and lower boll counts (Figure 4) compared to the dicamba treatments (Figure 2). An interesting aspect of the study was the amount of compensation the vegetative bolls had to yield, such as with treatment 7 (Figure 4). Also documented in Figure 4 is the greater number of vegetative bolls for the non-control treatments. This was most likely due to the study being furrow irrigated allowing the vegetative branches to continue to grow after the fruiting branch's sustained injury. Fiber quality values were also evaluated but any discounts or premiums associated with individual treatments were overshadowed by individual yield results.

Figure 5: Treatment Height Differences

Figure 6: 2,4-D Damage

Conclusions

- Cotton was 20X more susceptible to 2,4-D than dicamba for visual injury
- Dicamba recovery treatments showed no statistical yield difference, despite large numerical difference
- 2,4-D recovery treatments 15 & 20 did not show a statistical yield benefit and need to be evaluated further
- Treatment 7&17 was the only treatment that had a numerical benefit for both dicamba and 2,4-D
- Hormonal recovery treatments appear to have a greater response than nutritional treatments

Future Research

- The next phases of this research will be to select more hormonal products and a range of higher rates to manufacture a significant yield response.
- The study plans to also include more locations from varying geographies and climates across the Cotton Belt, including dryland locations to simulate a grander representative of national cotton acres and will impact how cotton plants will be able to recovery, after injury.

Acknowledgements

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