THE EFFECTS OF SIMULATED 2,4-D DRIFT ON COTTON GROWTH, DEVELOPMENT, AND YIELD

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Abstract

Cotton has been observed to be very sensitive to synthetic auxin herbicides such as 2,4-D. Physical injury of these herbicides, especially 2,4-D, is often observed in cotton in the Southeastern U.S., due to volatility, physical drift, and/or ineffective tank cleaning. Currently, the incidence of these issues is relatively infrequent, but severe yield penalties can be observed. However, the release of 2,4-D-tolerant technologies in the near future will likely increase the incidence of physical drift onto non-tolerant cotton, as the interface between tolerant and non-tolerant fields increase in Georgia. Currently, there are few tools available to effectively quantify potential yield losses due to 2,4-D drift, necessitating research that evaluates the effects of 2,4-D drift onto non-tolerant cotton at various developmental stages, with regard to growth, maturity, and yield.

Cotton (PHY 499 WRF) was planted in an irrigated environment at a rate of 3.5 sd/ft on April 25, 2013 on a Tifton sandy loam in Tifton, GA, and on May 1, 2013 in Moultrie, GA. On the center two rows of each four-row plot, 2,4-D amine (4 lbs a.i./gal) was applied at either 0.00178 (low rate; 1/421 X) or 0.0357 (high rate; 1/21 X) lbs a.i./A at the 4-leaf, 9-leaf, First Bloom (FB), FB+2 weeks, FB+4 weeks, and FB+6 weeks growth stages, using a CO2-pressurized backpack sprayer calibrated to deliver 15 GPA at 3 mph. Treatments were arranged in a randomized complete block design and were replicated four times. Percent injury, plant height, and nodes above white bloom (when possible) were evaluated throughout the season. Prior to harvest, 10 plants per plot were removed for mapping of boll distribution. All data were subjected to Analysis of Variance, and means were separated using Fisher's Protected LSD at $p \leq 0.05$. Harvest of treatment rows was conducted using a spindle-type picker to determine yield.

At Moultrie, the low rate of 2,4-D only affected the number of sympodial bolls per 10 plants when applied at first bloom, but had no effect on sympodial bolls when applied at any other growth stage. The high rate significantly reduced the number of sympodial bolls at the 9-leaf stage, most severely at first bloom, FB+2wk and FB+4wk but not at earlier or later growth stages. Seedcotton yield reduced when the low rate was applied at the 9-leaf stage, First Bloom, and FB+2wk but not at other growth stages. Seedcotton yield was reduced when the high rate was applied at all growth stages except for FB+6wk. The most severe yield reduction occurred when the high rate was applied at the 9-leaf stage followed by First Bloom. At Tifton, neither rate of 2,4-D affected the number of sympodial bolls per 10 plants when compared to the non-treated control, however differences among 2,4-D treatments were observed. Seedcotton yield was also not affected by the low rate. However, the high rate reduced seedcotton yield when applied at all growth stages except for FB+6wk. The greatest yield reduction occurred when the high rate was applied at First Bloom and FB+2wk, contrary to observations at the Moultrie location.

This data suggests that 2,4-D drift can adversely affect plant growth and yield, depending on the severity of drift or injury, as expected. It appears that non-tolerant cotton is most yield-sensitive to severe 2,4-D drift injury when drift occurs between 9-leaf and FB+2wk, and to a lesser extent at more distant growth stages. However, potential yield losses may not always correlate to the number of sympodial bolls alone, but accounting for boll size and proportion of open bolls at harvest may improve yield loss predictions. The authors extend a special thanks to the Georgia Cotton Commission for funding this and other research.