THE EFFECTS OF 2,4-D DRIFT ON COTTON AT VARIOUS GROWTH STAGES

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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 seed/ft on April 26, 2012 on a Tifton sandy loam. 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, or First Bloom + 2 weeks growth stages, using a CO^2-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. Mapping of boll distribution was conducted on a "per foot of stalk" basis rather than a "per node and position" basis, due to the split-terminal distortion effect of 2,4-D at some rates and growth stages. All data were subjected regression analysis, as well as to Analysis of Variance, and means were separated using Fisher's Protected LSD at $p \leq 0.05$.

The low 2,4-D rate had little effect on boll distribution with only mild reductions observed in the 2nd foot of stalk. The high 2,4-D rate applied at 9-leaf and beyond reduced the number of bolls in most regions. When applied at the 4-leaf stage, the high rate reduced the number of bolls on the 1st foot of stalk, but increased the number of bolls on the 3rd foot of stalk, suggesting a delay in maturity. On a whole-plant basis, only the high rate applied at First Bloom or First Bloom + 2 weeks reduced the number of bolls per 10 plants when compared to the non-treated control (fig. 3).

Plant height at the end of the season was only mildly affected by 2,4-D treatment, with the only significant reduction resulting from the high rate applied at the 4-leaf stage. More importantly, the low rate did not adversely affect yields, however the high rate reduced yield when applied at all growth stages. Yield losses were greatest when the high rate was applied at first bloom, followed by first bloom + 2 wk, 9-leaf, and the 4-leaf stage.

This data suggests that 2,4-D drift can adversely affect plant growth and maturity, 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 at or near First Bloom, and to a lesser extent at more distant growth stages. The differential effect of drift rate on yield illustrates the importance of quantifying injury or the concentration of 2,4-D in leaf tissue when making yield loss assessments. The authors extend a special thanks to the Georgia Cotton Commission for funding this and other research activities.