COTTON (*GOSSYPIUM HIRSUTUM*) DEFOLIATION AS AFFECTED BY DROPLET SIZE AND CARRIER VOLUME

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Abstract

In 2018 and 2019, a field experiment was conducted to evaluate the effect of carrier volume and spray droplet size on the efficacy of cotton (*Gossypium hirsutum*) defoliation programs. This experiment was conducted at the R.R. Foil Plant Science and Research Center in Starkville, Mississippi and at the Black Belt Branch and Experiment Station in Brooksville, Mississippi. Eight-row (7.7m x 12.1m) plots were planted to DP 1646 B2XF. Initial harvest aid applications were made at 60% open boll, and secondary applications to select plots occurred 12 days later.

Applications were made with a Capstan® Pinpoint Pulse-Width Modulation (PWM) sprayer on a high-clearance Bowman Mudmaster at a speed of 14.5 km hour^{-1}. This experiment utilized two carrier volumes: 47 and 187 L ha^{-1}, and three droplet sizes: 200 µm, 500 µm, and 800 µm. Defoliation materials included: thidiazuron (TakeDown® SC) applied at 0.15 kg ha^{-1}, ethephon (BollBuster®) applied at 1.5 kg ha^{-1}, tribufos (Folex® 6EC) applied at 0.37 kg ha^{-1}, and pyraflufen-ethyl (ET®) applied at 0.105 kg ha^{-1}. Defoliation programs included: [1A] thidiazuron + ethephon and [1B] thidiazuron + ethephon + tribufos, [2A] 1A + pyraflufen-ethyl + ethephon, and [2B] 1B + pyraflufen-ethyl + ethephon.

Visual ratings were taken at 3, 7, and 10 days after application (DAT) for both A and B applications, and included open bolls, green leaves, defoliation, desiccation, and terminal regrowth and basal regrowth. All ratings were normalized to the non-treated control. The center two rows were mechanically using a spindle picker modified for plot research., and seed cotton samples for each plot (4.5 kg) were sent to the University of Tennessee in Jackson, TN for ginning. Fiber quality was determined by the USA classing office in Memphis, TN.

The experimental design was a factorial arrangement of treatments within a randomized complete block and included four replications, each with a non-treated control. Data were analyzed in SAS v. 9.4 using PROC MIXED. Means were separated using Fisher's Protected LSD at an alpha level of 0.05. Results did not vary across year or location, and were therefore pooled across these factors.

Green leaves 10 days after application A (DAA) varied due to a program*carrier volume*droplet size interaction ($p = 0.0142$). Thidiazuron + ethephon applied at 187 L ha^{-1} with 800µm spray droplets left 23% green leaves on the plant, with all other treatments leaving ≤ 12%. Defoliation 10 DAA varied due to carrier volume ($p = 0.0077$) and a program*spray droplet size interaction ($p = 0.0056$). A carrier volume of 47 L ha^{-1} resulted in 5% more defoliation than 187 L ha^{-1}. Furthermore when pooled across carrier volume, applications of thidiazuron + ethephon with 800µm spray resulted in only 80% defoliation, with all other treatments > 90%.

Green leaves 7 days after application B (DAB) a carrier volume*droplet size interaction ($p = 0.0181$). A carrier volume of 47 L ha^{-1} and 800 µm droplets left 19% green leaves on the plant. Conversely, applications of either carrier volume and 200 µm droplets left ≤ 9 % green leaves. Defoliation 7 days after application B (DAB) varied due to program ($p = 0.0236$), carrier volume ($p = 0.0130$), spray droplet size ($p < 0.0001$), and a carrier volume*droplet size interaction ($p = 0.0181$). Initial defoliation applications that did not contain tribufos resulted in 3% more defoliation than those that did. A carrier volume of 187 L ha^{-1} resulted in 2.5% more defoliation than 47 L ha^{-1}, and spray droplet sizes of 200 µm resulted in 2.5% more defoliation than 500 µm, and 7.5% more than 800 µm.

In this study, we observed no impact on open bolls, regrowth, fiber quality, or seedcotton yield. As such, our conclusions reflect the impact of defoliation efficacy only. Therefore, these data indicate that lower carrier volumes have a utility in cotton defoliation programs. We hypothesize this is due to the increased concentration of active ingredient within each spray droplet. Secondary applications, if necessary, will benefit from higher carrier volumes and fine spray droplets due to increased coverage of the remaining plant material.