COMPARISON OF BT CULTIVARS FOR CONTROL OF COTTON BOLLWORM WITH AND WITHOUT A FOLIAR APPLICATION IN ARKANSAS, 2017

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Abstract:

The bollworm is a very important pest of cotton in Arkansas and can cause significant yield losses if not controlled. An increasing amount of fruit damage has been observed in dual gene cotton cultivars in the last several years. The objective of this study was to evaluate the efficacy of dual gene and triple gene *Bt* cotton cultivars in sprayed and unsprayed conditions. Results indicated that dual gene cultivars may require supplemental foliar applications for control high populations of bollworms while triple gene cultivars did not benefit from supplemental foliar applications.

Introduction:

Cotton is a high input crop for growers and many are struggling to make a profit due to increasing costs of technology fees, insecticide applications, weed control, and field maintenance make it imperative to find ways of saving money for growers. Each year, the cotton bollworm (*Helicoverpa zea,* Bodie*),* infests 100% of all cotton planted in Arkansas. It remains a major pest of post-bloom cotton in the Mid-South despite widespread use of transgenic *Bt* cotton varieties. In recent years 98%-100% of the cotton acreage in Arkansas was planted with dual gene *Bt* cultivars (Williams, et. al., 2016). A recent meta-analysis of cotton data since 2007 throughout the Mid-South indicates that there has been increasing amounts of square damage. This suggests that there may be some tolerance developing to dual gene technologies for cotton bollworm (personal communication, G. Lorenz). Studies in 2017 by Kerns, et. al. indicate there is widespread resistance to Cry1AC, the major gene associated with *Bt* cotton. Recent research has established a new bollworm threshold based on damaged fruit rather than insect numbers with the new threshold being set at 6% fruit damage. Economic losses from bollworm to the grower is based on cost of treatment and reduction in yield due to this pest, which has added up to more than $1.7 million in total losses, averaging $9.41 per acre (Williams, et. al., 2016).

The objective of this study was to evaluate the efficacy of dual-gene and triple gene *Bt* cottons, specifically Bollgard II, WideStrike, WideStrike III, TwinLink, and TwinLink Plus for control of cotton bollworm in sprayed and unsprayed conditions. This study monitors current and emerging technology to help growers make informed decisions.

Materials and Methods:

A trial was conducted on a grower field in Jefferson County, Arkansas 2017. Plot size was 12.5 ft. (4rows) by 40 ft., in a randomized complete block design with 4 replications. Varieties used consisted of Non-*Bt* (DP1441 RF); WideStrike (PHY 333 WRF); WideStrike 3 (Phy330 W3FE); TwinLink (ST4949 GLT); TwinLink Plus (ST 5517GLTP); Bollgard 2 (ST4946 GLB2). Spray timings included: 1) non-treated, and 2) treated. Sprayed plots were treated with a foliar application of Prevathon at 20 oz/acre on July 24. Application was made using a Mudmaster high clearance sprayer fitted with 80-02 dual flat fan nozzles at 19.5 inch spacing with a spray volume of 10 gal/acre and 40 psi. Damage ratings were taken 2, 9, 17, and 23 days after application (DAA) by sampling 25 squares, blooms, and bolls per plot. Plots were harvested using a John Deere two row plot picker. The data was

processed using Agriculture Research Manager 2017 (Gylling Data Management, Inc., Brookings, S.D.) and Duncan's New Multiple Range Test (P=0.10) to separate means. Means followed by same letter do not significantly differ (P=.10, DNMRT). Mean comparisons performed only when AOV Treatment P (F) is significant at mean comparison OSL.

Results and Discussion:

All plots had less damage than the untreated non-*Bt* control for each sampling date (Figures 1-4).

All of the *Bt* varieties had less damage than the sprayed non-*Bt* variety 2 DAA and were below the threshold (Figure 1).

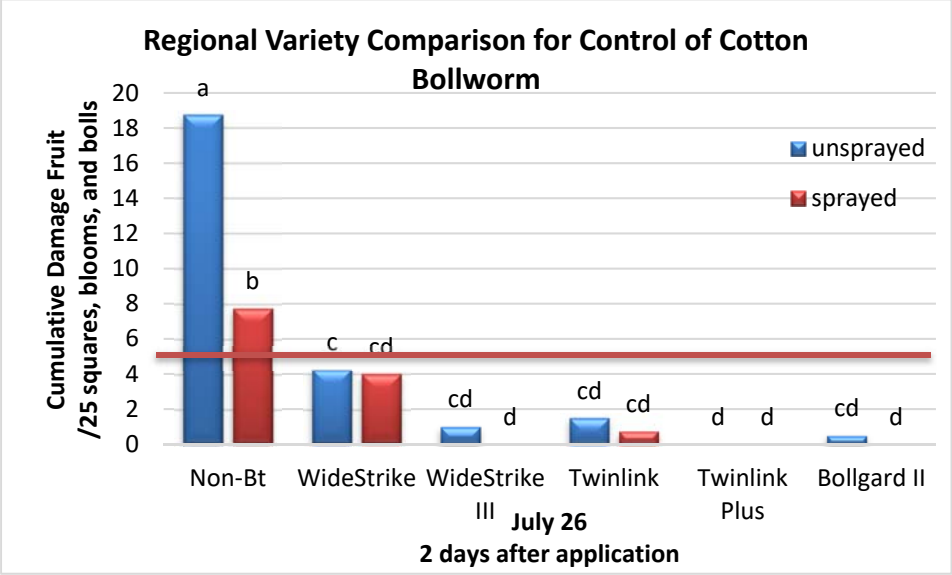

Figure 1: Cumulative damage of 25 squares, blooms, and bolls 2 days after application of Prevathon 20 oz.

At 9 DAA, the unsprayed WideStrike had more damage than all other plots (Fig. 2). The unsprayed WideStrike, BGII, and TwinLink had damage at or above the 6% damage threshold. There was also a trend for the dual gene *Bt* varieties to have more damage than the triple gene *Bt* varieties, although this was not significant.
Similar results were observed 17 days after application (Fig. 3).

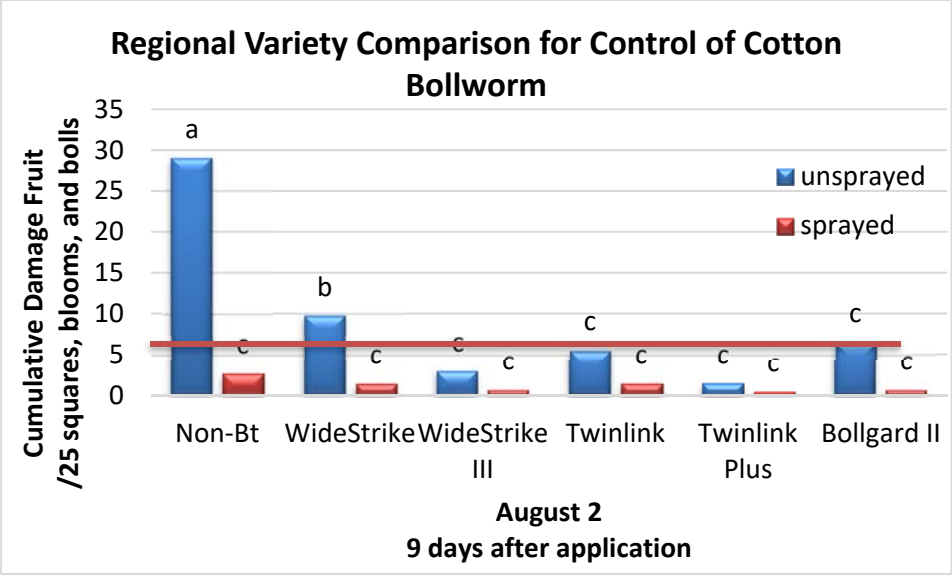

Figure 2: Cumulative damage of 25 squares, blooms, and bolls 9 days after application of Prevathon 20 oz.

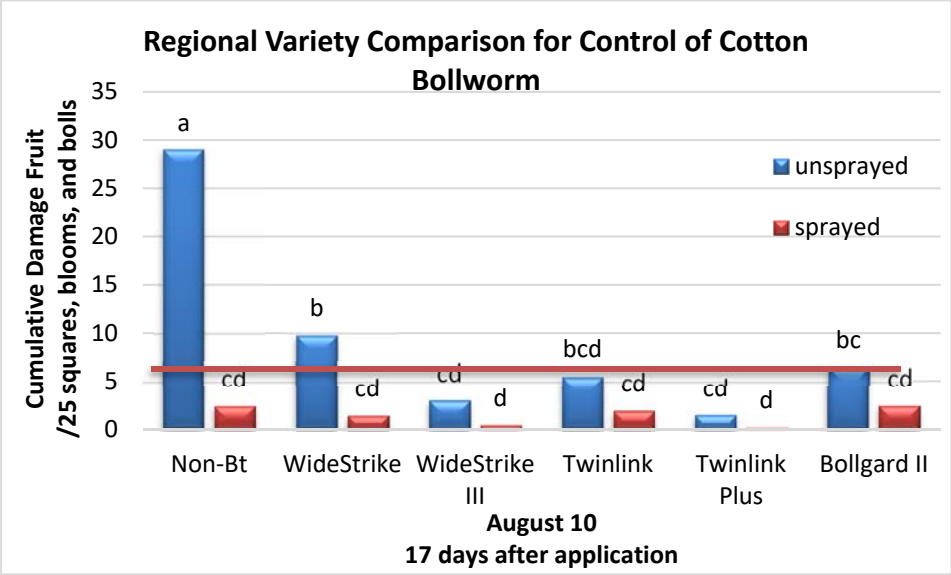

Figure 3: Cumulative damage of 25 squares, blooms, and bolls 17 days after application of Prevathon 20 oz.

At 23 days after application, unsprayed WideStrike had more damage than all other transgenic plots (Fig. 4). The unsprayed dual gene varieties, though not always significant, had damage levels exceeding the threshold of 6% damaged fruit.

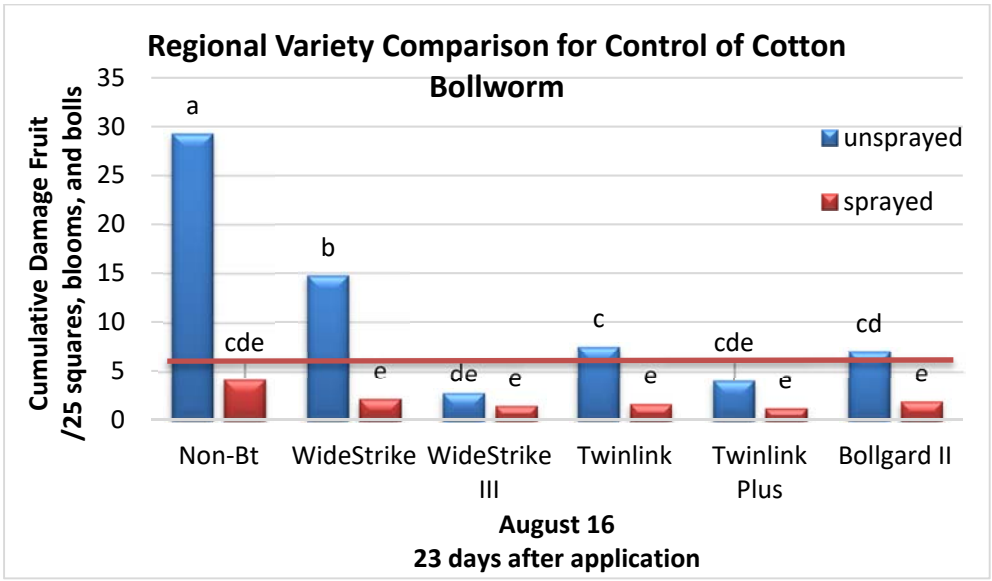

Figure 4: Cumulative damage of 25 squares, blooms, and bolls 23 days after application of Prevathon 20 oz.

Non-Bt and Widestrike had higher yields when foliar applications were made for control of bollworms (Fig. 5). No difference was observed for BG II. Widestrike III and TwinLink Plus also showed no difference between sprayed and unsprayed treatments.

Yield results from previous studies, (Lorenz, et al., 2012; Taillon, et al., 2013; Orellana, et al., 2014), show the impact of foliar applications on transgenic cultivars varies from year to year. In 2012, foliar applications increased

yield in Bollgard II and WideStrike but in 2013 and 2014 yields did not increase with foliar applications. This would indicate that bollworm numbers from year to year are the determining factor on the need for supplemental foliar applications.

This study indicates that dual gene *Bt* varieties may not provide the protection needed to prevent fruit damage from bollworms and may require foliar applications in years when populations of bollworm are high. In this study, the newer triple gene *Bt* varieties are currently providing the control needed to maximize yield without requiring foliar applications. Studies should be continued to monitor these trends and keep growers informed of their choices.

References:

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