EVALUATION OF BOLLWORM MANAGEMENT OPTIONS IN VIRGINIA

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Abstract

Previous research has shown that cotton varieties with insect-resistant genetics require one or more bollworm insecticide applications to achieve yields comparable to that of conventional cotton varieties that receive two applications. This research compared lint yields and value of non-insect resistant (conventional, RF) and double insect resistance gene (BG2, WS, or D) cotton varieties, with and without bollworm insecticide treatment. Data collected included percent square retention and internal damage due to sucking bugs, external damage to bolls due to bollworm, and yield. Results showed that double-gene varieties left untreated for bollworm had greatly reduced boll damage compared to an untreated conventional variety. A single insecticide application targeted towards bollworm in double-gene varieties increased yield by 0-254 lb lint/acre, while two applications in the conventional variety increased yield by 716 lb lint/acre. Under our cost parameters, insecticide application returned $-9 to 63/acre in BG2/D (double-gene) varieties; $89-130/acre in WS (double-gene) varieties; and were most valuable for the RF (conventional) variety, returning $377/acre.

Introduction

Previous research at the Tidewater Agricultural Research and Extension Center (TAREC) has shown that cotton with insect-resistant genetics still require at least one bollworm pesticide application to achieve yields comparable to that of conventional cotton that has received two sprays. Also, Virginia cotton variety trials since 2005 have shown that, in general, double-gene insect resistant cotton varieties do not always perform as well as other varieties in terms of lint yield. The objective of this research was to compare lint yield and value of conventional and double-gene insect resistant cotton varieties with and without bollworm insecticide treatment.

Materials and Methods

Research was conducted at the Virginia Tech TAREC in Suffolk, Virginia, in 2008. In trial 1, varieties were selected from two groupings based on level of insect resistance: non-insect resistant, or conventional (RF), and double insect resistance gene, or double-gene (BG2, WS, or D). Varieties were selected based on official variety test performances in Virginia and North Carolina using only the highest yielding varieties from each grouping. Plots were 4 rows (36-inch row center) by 35 ft long. Experimental design was a four-replicate split-plot with insecticide treated vs. untreated as the main plot and variety as the sub-plot. In treated plots, plant bug and stink bug were managed with two insecticide applications, one in mid-July (Centric @ 2 oz/acre), the second in late July (Orthene 97 @ 8 oz/acre). Treated plots received bollworm protection with an application of Baythroid XL @ 2.6 oz/acre on August 12. The treated plots of the conventional variety 'PHY 425 RF' also received Baythroid XL @ 1.6 oz/acre eight days prior to the 2.6 oz/acre application. Plant bug and stink bug were monitored by assessing square retention on five randomly selected plants per plot and percent internal bug-induced boll damage on five randomly selected bolls per plot. Bollworm was monitored by assessing external boll damage on 25 randomly selected bolls per plot. Cotton was harvested from two rows of each plot using a commercial John Deere cotton picker. A one-pound subsample was ginned from each plot to determine the lint:seed/trash ratio. The value of each variety was determined by comparing lint value ($0.55/lb) to insecticide treatment cost, based on Baythroid XL at $1.68/oz (PHY 425 RF with 1.6 oz + 2.6 oz, and all other varieties with 2.6 oz) with an application cost of $5 per acre.

Methods for trial 2 were similar to trial 1, except for using a randomized complete block design and not applying insecticides for bollworm management (no August Baythroid application). Two conventional and three double-gene (WS) varieties were evaluated for plant bug/stink bug damage, bollworm damage, and yield, as described above.

Results and Discussion

Trial 1

Square retention was 92-98% in untreated cotton and 93-99% in treated cotton. Untreated double-gene varieties had 0-3% bollworm damage and were statistically the same, while the conventional variety had 42% bollworm damage, significantly greater than the double-gene varieties (Figure 1). Treated cotton had 0-2% bollworm damage and there was no significant difference among varieties, indicating the effectiveness of the insecticide treatments (Figure 2). An average increase of 80 lb lint/acre was realized by treating double-gene varieties with a bollworm treatment; only two of the double-gene varieties did not benefit from this application (Figure 3). Similar results were seen in 2007 with a 64 lb lint/acre average yield increase in double-gene varieties after a bollworm treatment (Herbert et al. 2007). Depending on market conditions and the cost of insecticide and its application, a gain of 64-80 lb lint/acre may justify protecting double-gene varieties with a single bollworm insecticide application—Figure 4 shows an average gain of $35/acre in 2008. Of the double-gene varieties, the two containing the WS gene benefitted the most from insecticide treatment for bollworm. Yield of the conventional variety was increased by 716 lb lint/acre with two bollworm treatments (Figure 3), resulting in a profit of $377 (Figure 4). Current insect-resistant varieties do not protect against plant bug or stink bug injury, so additional applications may be required to protect against these pests.

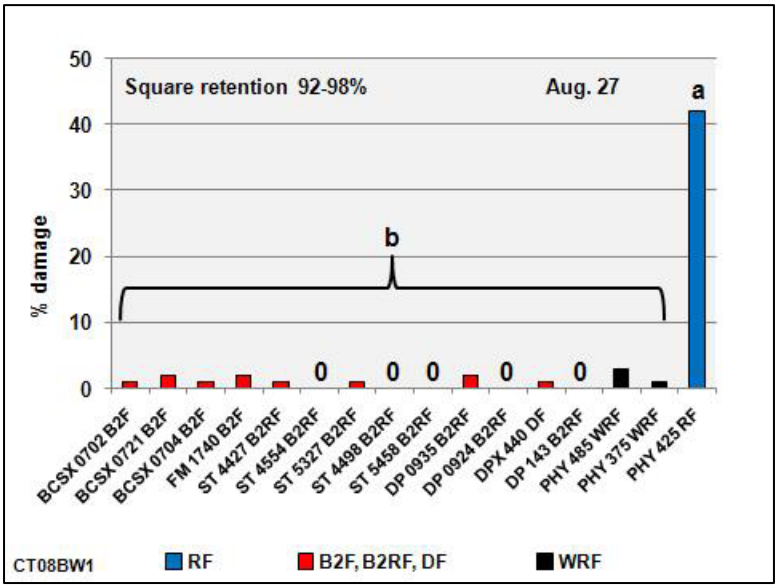

Figure 1. Percent bollworm damage to bolls on 16 untreated cotton varieties—TAREC, 2008.

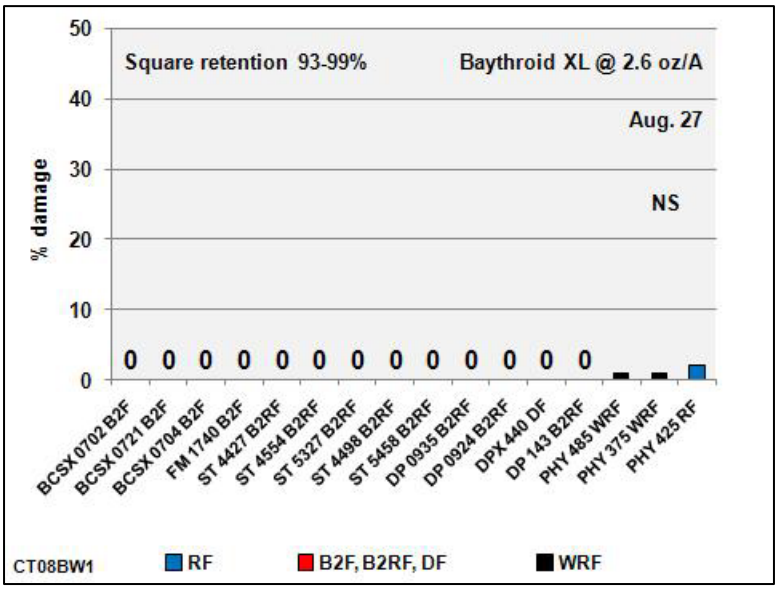

Figure 2. Percent bollworm damage to bolls on 16 treated cotton varieties—TAREC, 2008.

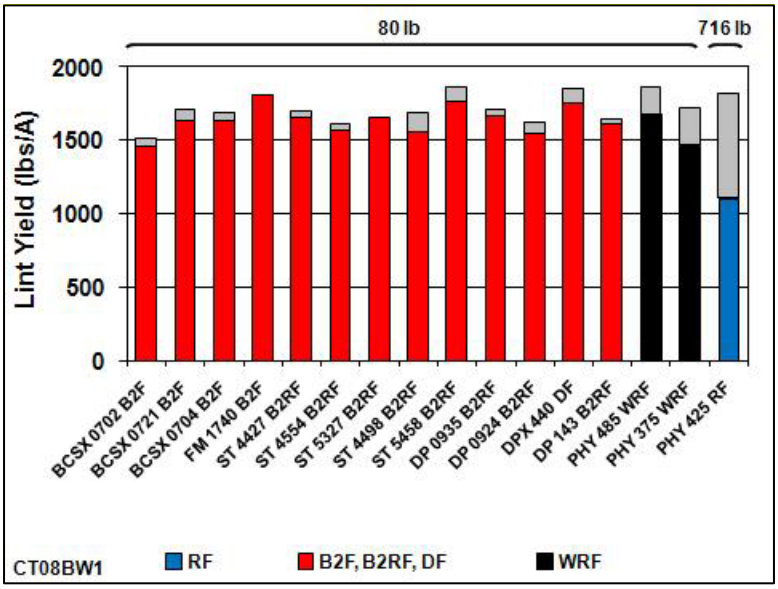

Figure 3. Yield increase with insecticide sprays.

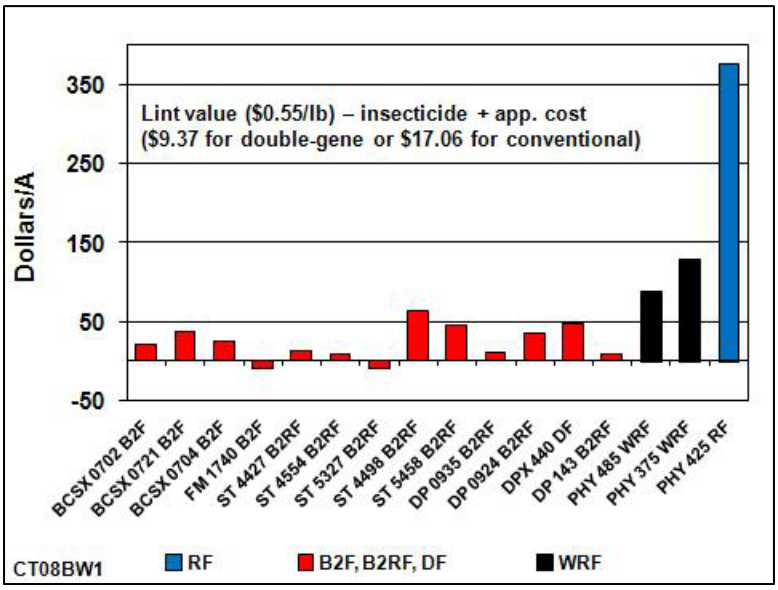

Figure 4. Value of lint gain due to insecticide sprays.

Trial 2

In this test, which was not treated with insecticides for bollworm management, square retention was 93-99% and internal bug-induced boll damage was 0-10%, with no differences between varieties (Figure 5). All three double-gene varieties had less bollworm damage than conventional varieties on all sample dates, resulting in an average increase of 461 lb lint/acre over the conventional varieties.

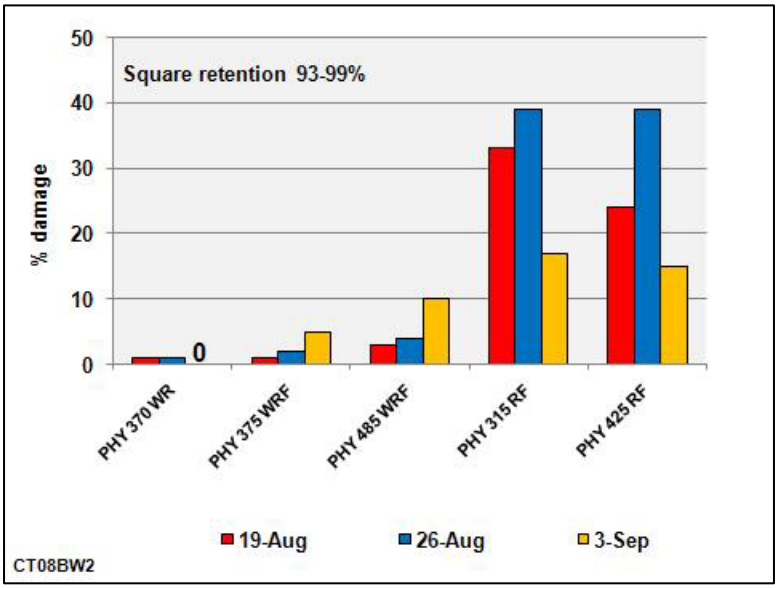

Figure 5. Percent bollworm damage to bolls on 5 untreated cotton varieties—TAREC, 2008.

Summary

At TAREC, conventional cotton that did not receive protection from bollworm had approximately 40% boll damage in 2008. Double insect resistant gene varieties had much less bollworm damage, but generally would have benefitted from a single insecticide application for this pest. As an additional benefit, a bollworm pesticide application would help to keep sucking bugs in check. It would be up to the grower to determine if the yield gained from applying such a treatment would translate into profit under current economic conditions.

Reference

Herbert, D.A. and S. Malone. 2008. Assessment of lepidopteran-protected cotton varieties in Virginia. Proc. Beltwide Cotton Conf., Nashville, TN. 8-11 Jan. 2008. Natl. Cotton Counc. Am., Memphis, TN.