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EVALUATING VipCot AGAINST LEPIDOPTERAN PESTS IN LOUISIANA

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Abstract

The bollworm, *Helicoverpa zea* (Boddie), and tobacco budworm, *Heliothis virescens* (F.) have historically been major pests of cotton in Louisiana. Studies were conducted during 2002 and 2003 to evaluate the performance of the VipCot technology against bollworm and tobacco budworm infestations in Louisiana. The VipCot technology reduced damaged squares and bolls compared to conventional cotton without heliothine control, with few exceptions. VipCot provided yield protection against heliothines similar to the insecticide-based control strategy applied to conventional cotton.

Introduction

The first transgenic cotton cultivars expressing insecticidal traits (Bollgard®) were approved by the Environmental Protection Agency in 1996. Bollgard® cotton cultivars produce the Cry1Ac protein from *Bacillus thuringiensis* Berliner var. *kurstaki* (*Bt*), which exhibits toxicity to larvae of many lepidopteran cotton pests (Perlak et al. 1990). The Bollgard® technology has been very effective at controlling tobacco budworm, *Heliothis virescens* (F.). However, Bollgard demonstrates limited activity against other lepidopteran pests such as bollworm, *Helicoverpa zea* (Boddie); armyworms, *Spodoptera* spp.; and soybean looper, *Pseudoplusia includens* (Walker). Large or persistent infestations of lepidopteran pests such as bollworm have required supplemental insecticide applications to prevent economic injury (Bacheler and Mott 1997, Leonard et al. 1997, Layton et al. 1997, Stewart et al. 2001).

Recent advances in genetic engineering technologies have produced a second generation of caterpillar resistant cotton. Some of these cotton lines under development contain two separate *Bt* proteins to improve efficacy against several lepidopteran pests. Monsanto's new transgenic *Bt* cotton (Bollgard II) was derived by incorporating the Cry2Ab protein from *Bt* into Bollgard cotton varieties (Greenplate et al. 2000a, 2000b). New experimental transgenic cotton lines from Dow Agrosciences express the Cry1Ac and Cry1F Bt proteins (Pellow et al. 2002). Syngenta's experimental VipCot cotton lines express a protein from *Bt* that is different in structure and mode of action than proteins expressed by other transgenic cottons (Estruch et al. 1996). Mascarenhas et al. (2003) reported that VipCot technology provided satisfactory control of bollworm and tobacco budworm in Alabama, Arkansas, Georgia, Louisiana, Mississippi, North Carolina, and Texas. The objective of these studies was to evaluate the performance of Syngenta's VipCot technology against heliothine and foliage-feeding pests of cotton.

Materials and Methods

These studies were conducted at the Macon Ridge Research Station, near Winnsboro, LA during 2002 and 2003. The experimental design was a randomized complete block design with a split plot arrangement of treatments. The main plot factor was heliothine control strategy which included non-treated and insecticide-based heliothine control strategies. The subplot factor was cotton genotype and included conventional cotton (Coker 312) and VipCot transgenic cotton (Coker 312, transformed). Treatments were replicated four times for each year. For this report, the treatments of interest included conventional cotton without heliothine control (non-treated control), conventional cotton with insecticide oversprays for heliothines, and VipCot cotton without heliothine oversprays. The studies were planted on 20 May, 2002 and 30 May, 2003. Treatment efficacy was determined by examining 25 squares per plot for evidence of heliothine feeding on 10, 15, 19, 22, 25 Jul; 1, 5, 8, 13, 19, 22, 28 Aug; and 5 Sep, 2002 and on 24, 29 Jul; 1, 6, 12, 19, 22, and 27 Aug, 2003. Numbers of heliothine damaged bolls were determined by examining 25 bolls per plot on 25 Jul; 1, 5, 8, 13, 19, 22, 28, Aug; and 5 Sep, 2002 and on 6, 12, 19, 22, 27 Aug, 2; 10, and 17 Sep, 2003. Densities of soybean looper larvae were determined by sampling 10 feet of row with a shake cloth on 28 Aug and 12 Sep, 2002. Plots were mechanically harvested on 14 Oct, 2002 and 3 Nov, 2003.

Results and Discussion

During 2002, the VipCot cotton plots and the conventional cotton plots with insecticide oversprays for heliothines had fewer cumulative heliothine damaged squares than the conventional cotton plots without heliothine control (Figure 1). Numbers of damaged squares in the VipCot plots were similar to that observed in the conventional cotton plots with heliothine control during the entire sampling period. During 2003, the VipCot cotton plots and the conventional cotton plots with heliothine oversprays had fewer cumulative heliothine damaged squares compared to the conventional cotton plots without heliothine control (Figure 2). Cumulative square damage in the VipCot cotton plots was slightly higher than that observed in the conventional cotton plots with heliothine oversprays across all sample dates.

The conventional cotton plots without heliothine control had higher cumulative numbers of heliothine damaged bolls than the VipCot cotton plots and the conventional cotton plots with heliothine oversprays during 2002 (Figure 3). Damaged bolls in the VipCot cotton plots was similar to that observed in the conventional cotton plots with heliothine oversprays across the entire sampling period. During 2003, cumulative damaged bolls in the VipCot cotton plots was similar to that observed in the conventional cotton plots without heliothine control from 6 Aug to 27 Aug (Figure 4). From 2 Sep to 17 Sep, cumulative damaged bolls in the VipCot cotton plots was lower than that observed in the conventional cotton plots without heliothine control.

The conventional cotton plots with heliothine oversprays and the VipCot plots had significantly lower densities of soybean looper larvae compared to the conventional cotton plots without heliothine control during 2002 (Figure 5). Seedcotton yields of the VipCot plots and the conventional cotton plots with heliothine oversprays were significantly higher than that for the conventional cotton plots without heliothine control during 2002 and 2003 (Figures 6 and 7). Yields of the VipCot plots were similar to those observed in the conventional cotton plots with heliothine control during both years.

The results from these studies are similar to those reported by Mascarenhas et al. (2003). The VipCot technology reduced damaged squares, damaged bolls, and soybean looper densities compared to the conventional cotton without heliothine control, with few exceptions. The VipCot technology provided protection against yield loss from heliothine infestations similar to that provided by the insecticide based control strategy.

Acknowledgments

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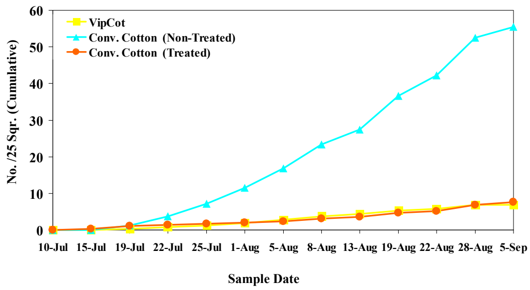

Figure 1. Cumulative number of heliothine damaged squares in VipCot, treated conventional, and non-treated conventional cotton plots during 2002.

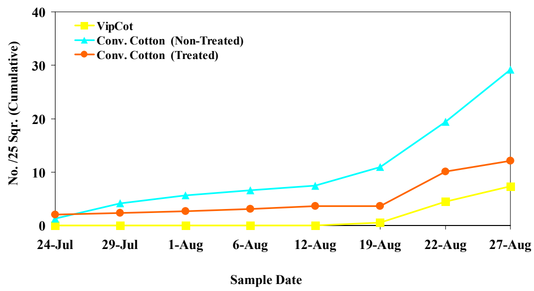

Figure 2. Cumulative number of heliothine damaged squares in VipCot, treated conventional, and non-treated conventional cotton plants during 2003.

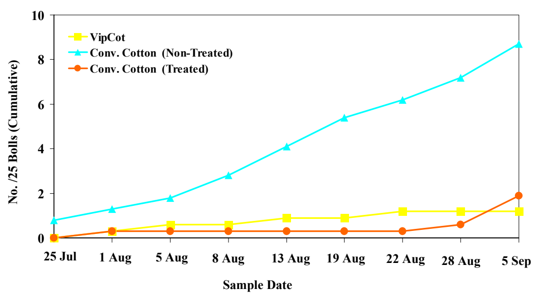

Figure 3. Cumulative number of heliothine damaged bolls in VipCot, treated conventional, and non-treated conventional cotton plots during 2002.

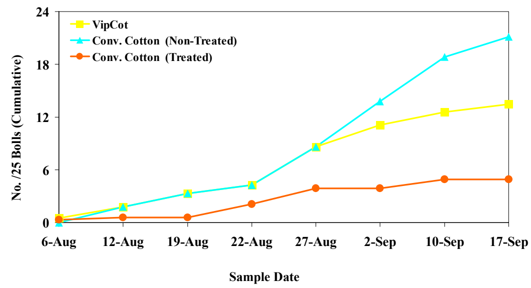

Figure 4. Cumulative number of heliothine damaged bolls in VipCot, treated conventional, and non-treated conventional cotton plots during 2003.

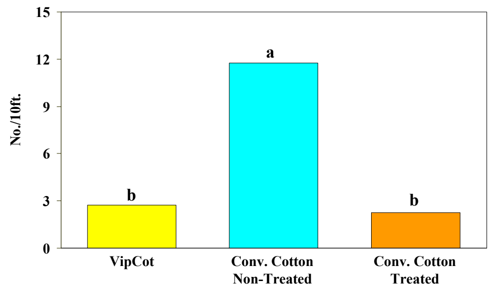

Figure 5. Densities of soybean looper larvae in VipCot, treated conventional, and non-treated conventional cotton plots in 2002.

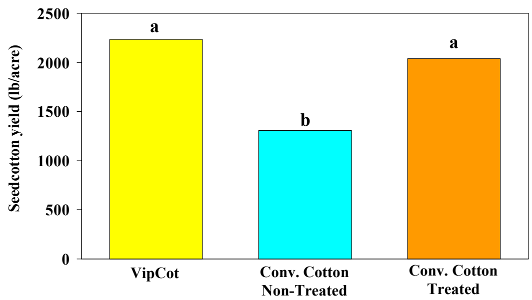

Figure 6. Impact of heliothine control strategy on seedcotton yield during 2002.

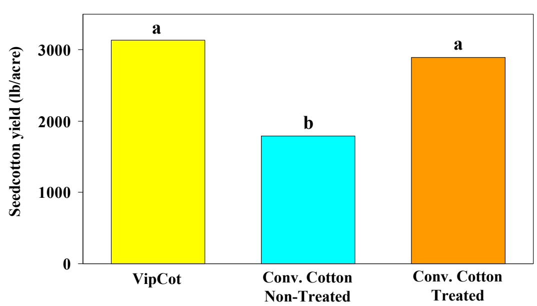

Figure 7. Impact of heliothine control strategy on seedcotton yield during 2003.