FOUR-YEAR COMPARISON OF WIDESTRIKE PERFORMANCE IN LOUISIANA

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Introduction

In 1996, Bollgard® was approved for commercial use by the Environmental Protection Agency (EPA). This genetic engineering technology utilizes the Cry1Ac protein produced by the bacterium, *Bacillus thuringiensis* (Bt) Berliner var. *kurstaki*, which has been incorporated into the genome of many cotton varieties. The primary targets that are satisfactorily controlled with Bollgard cotton varieties include the tobacco budworm, *Heliothis virescens* (F.) and the pink bollworm, *Pectinophora gossypiella* (Saunders) (Perlak et al. 1990). Other caterpillar pests such as armyworms, *Spodoptera* spp.; soybean looper (SBL), *Pseudoplusia includens* (Walker); and bollworm, *Helicoverpa zea* (Boddie) may require insecticide applications to supplement the performance of the Bollgard technology (Bacheler and Mott 1997, Gore et al 2003).

In recent years, a second generation of genetically modified cotton cultivars has been approved for commercial use. The registration of Monsanto's Bollgard II® (Cry 1Ac + Cry2Ab proteins) technology during 2002 and Dow AgroScience's 2005 commercial introduction of WideStrike™ (Cry 1Ac + Cry 1F proteins) product provided cotton producers with the opportunity to plant cotton lines with two *Bt* insecticidal toxins. WideStrike has demonstrated effective control of bollworm, soybean looper, beet armyworm (BAW), *Spodoptera exigua* (Hübner), and fall armyworm (FAW), *Spodoptera frugiperda* (J. E. Smith) (Pellow et al. 2002). From 2003 to 2007, the percentage of the total cotton acreage planted to parental Phytogen and WideStrike™ varieties has nearly doubled in Louisiana (personal communication, Reed Parker, Dow AgroSciences). As these varieties receive more recognition from their yield performance in Louisiana's official variety trials, cotton acreage planted with Phytogen and WideStrike™ cultivars will likely continue to increase.

The introduction of Bt cotton varieties in 1996 marked the end of an era in cotton IPM. The use of conventional chemical control strategies for caterpillar pests has decreased >50% and will likely continue to decline as newer Bt technologies are commercialized. These Bt technologies in cotton plants have resulted in higher yields and less economic risk for producers (Burd et al. 1999). Acceptance by the cotton industry has occurred at unprecedented levels. In 2007, approximately 85% of the total cotton acreage was planted to Bt varieties in Louisiana (United States Department of Agriculture, National Agriculture Statistics Service [USDA-NASS]).

The most recently registered Bt technology is WideStrike™ and published results of performance in field trials has been limited. Therefore, the objective of this report is to summarize the results of selected field trials that demonstrate WideStrike™ efficacy against target pests in Louisiana cotton fields.

Materials and Methods

All studies were performed at the Macon Ridge Research Station (LSU AgCenter) near Winnsboro, LA, during the period 2004-2007. The target insect pests included Heliothines (bollworm [BW] and tobacco budworm [TBW]), and late-season defoliators (soybean looper [SBL] and beet armyworm [BAW]). Cotton seed were planted into a

Gigger-Gilbert silt loam on 5, 10, 13, and 15 Jun during 2004, 2005, 2006, and 2007, respectively. Field plots consisted of 4-8 rows (40-inch centers) x 50 feet. Treatments were arranged in a randomized block design (RBD) with 4-6 replications. Normal cultural practices and integrated pest management strategies recommended by the Louisiana Cooperative Extension Service were used to optimize plant development and manage non-target insect pests during each year. There were no insecticide oversprays to affect the target pest populations throughout the duration of these tests. During 2004 and 2005, the non-Bt conventional and WideStrike™ varieties were Phytogen 410R and Phytogen 470WR, respectively. During 2006 and 2007, the non-Bt conventional and WideStrike™ varieties were Phytogen 425RF and Phytogen 485WRF, respectively. Treatments were evaluated by examining a combination of 50-100 flower buds (squares) and or bolls per plot on an individual sample date. Plots were sampled during 2004 (20, 23, 27,,30 Jul; and 3, 11, 16, 24,,30 Aug); 2005 (28 Jul; 1, 5, 11, 17, 26 Aug, and 1 Sep); 2006 (3, 7, 15, 21, 25,31 Aug; and 6 Sep); and 2007 (13, 17, 21, 28 Aug; and 4, 13 Sep) for evidence of BW and TBW-damaged fruiting forms and surviving larvae. WideStrike™ performance against target pests is summarized across all sampling dates within each year and across years. WideStrike™ efficacy was evaluated against SBL and BAW by recording the number of larvae per 2 shake sheet (3 x 3 ft cloth) samples/plot.

Results and Discussion

In a series of tests during 2004-2007, WideStrike™ (Phytogen 470WR, Phytogen 485WRF) cotton lines significantly reduced the number of Heliothine-damaged and larval-infested fruiting forms compared to that in conventional (Phytogen 410R and 425RF) cotton (Table 1). The non-Bt conventional cotton lines had 4.8 to 9.0-fold higher damaged squares than the WideStrike™ cotton varieties. WideStrike™ varieties also demonstrated satisfactory control of foliage feeding caterpillars including SBL and BAW (Figure 1).

Table 1. Mean seasonal percentage of fruiting forms infested with Heliothine larvae and associated damage for selected cotton genotypes (WideStrike™) and insecticide spray regimes[1].

Genotype	Percent damage	Percent larvae
Conventional	13.08	4.64
WideStrike™	1.1	0.49

[1]Summary of four trials in Louisiana during 2004-2007.

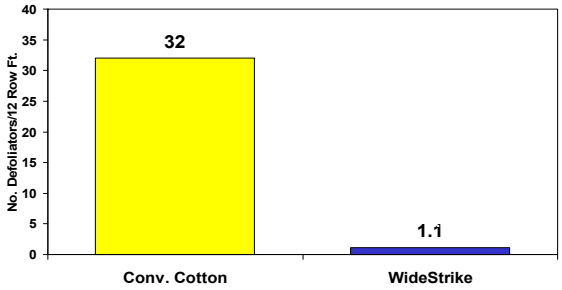

Figure. 1. Efficacy of WideStrike™ cotton varieties against foliage feeding pests.

WideStrike™ has demonstrated satisfactory control of several caterpillar pests including bollworm, soybean looper, beet armyworm, and fall armyworm. Based upon the data generated in Louisiana and from other state and federal scientists, these technologies will further reduce, and in some instances, eliminate supplemental control of caterpillar pests with foliar applications of conventional insecticides in cotton. However, WideStrike™, as well as the other Bt technologies, should be considered immune to injury by caterpillar pests due to interactions of cotton genotype, protein expression, and the field environment. WideStrike™ has not expressed activity against non-caterpillar pests. The application of non-selective insecticides that target caterpillar pests also inadvertently also controls numerous secondary cotton pests before populations can cause significant yield losses. To optimize the value of Bt traits such as WideStrike™, producers must diligently monitor and treat economic infestations of all non-target and secondary pests of cotton.

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