Performance of WideStrike Cotton in Arkansas, 2004-2005

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BACKGROUND INFORMATION

WideStrike cotton \([Gossypium hirsutum \ (L.)]\) containing the Cry1Ac and Cry1F endotoxin of \(Bacillus thuringiensis\) became commercially available to cotton producers in 2005. It is anticipated that WideStrike will provide cotton producers with effective control of heliothines, tobacco budworm, \(Heliothis virescens\) F., \(Helicoverpa zeae\), and other lepidopterous pests of cotton in Arkansas. The first transgenic, Bollgard, gave excellent control of tobacco budworm but has achieved less reliable control of bollworm, \(Helicoverpa zeae\) (Boodie) and various other lepidopterous pests and depended more on foliar insecticide treatments in conjunction with Bt variety (Lorenz et al., 2002).

WideStrike was developed to give additional control of lepidopterous pests and decrease the probability of population resistance of targeted pests with the additional toxin Cry1F. The only other transgenic with two endotoxins is Bollgard II®, which contains Cry1Ac and Cry2Ab. Previously conducted studies have shown Bollgard II to be effective in controlling bollworm, tobacco budworm, and soybean looper (Allen et al., 2000; Stewart et al., 2000; Ridge et al., 2000). The purpose of this study was to examine the efficacy of WideStrike, sprayed and unsprayed, compared to conventional cotton, sprayed and unsprayed, and Bollgard II for control of lepidopterous pests. Additional observations were made to compare agronomic characteristics of these varieties.

RESEARCH DESCRIPTION

All trials were conducted at Hooker Farms in Jefferson County, Ark., in 2004 and 2005. In 2004, the treatments utilized in the trial were WideStrike sprayed and unsprayed and conventional sprayed and unsprayed. PHY 470 WR was planted 10 May 2004 along with the conventional PHY 410 R. The field was planted and subdivided into 16-row plots using 38-inch row-spacing and 150-ft length. Foliar treatments of Prolex (0.016 lb ai/acre) were made as needed according to statewide threshold recommendation. This

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resulted in 3 applications to conventional cotton in the sprayed regimen. WideStrike plots received either 0, 1, or 2 foliar applications (see Fig. 1). Treatments were applied with a John Deere Hi-Cycle 6500 using a compressed-air delivery system using an 8-row boom with 19-inch nozzle spacing. The nozzles used for application were Tee-Jet TXVS 6. Operating pressure was 45 psi and 9.17 gal/acre of volume. Treatments were foliar-applied on 8 July, 13 July, and 20 July 2004. Observations were conducted on 12 July, 16 July, 19 July, 23 July, 26 July, and 29 July 2004. Data were collected from random samples of 25 terminals, 25 squares, 10 flowers, and 10 bolls. Plots were machine-picked on 25 October 2004.

In 2005 small plots trials, the treatments utilized were PHY 440 W and PHY 470 WR, 475 WRF, 410 R, and BG II (DPL 424). All cultivars were planted 6 May 2005. The field was planted and subdivided into 4-row plots with 4 rows of buffer between each plot. The trial was half treated and half untreated. Treatments were made according to statewide threshold recommendation. Treatments were applied with a John Deere Hi-Cycle 6500 using a compressed-air delivery system with an 8-row boom and 19-inch nozzle spacing. The nozzles used for application were Tee-Jet TXVS 6. Operating pressure was 45 psi and 9.59 gal/acre of volume. Treatments were foliar-applied on 14 July and 4 August 2005. Data were collected from random samples of 20 terminals, 40 squares, 40 flowers, and 40 bolls. Plots were machine-picked on 25 October 2005. Bidrin was applied on 24 July 2005 for plant-bug control on all plots at a rate of 0.5 lb ai/acre. Data were processed using Agriculture Research Manager Version 7. Analysis of variance and Duncan’s New Multiple Range Test (P=0.10) were conducted.

The treatments utilized in the large block trial were PHY 440, PHY 470, and BG II (DPL 424). All cultivars were planted 6 May 2005. Treatments were applied with a John Deere Hi-Cycle 6500 using a compressed-air delivery system with an 8-row boom and 19-inch nozzle spacing. The nozzles used for application were Tee-Jet TXVS 6. Operating pressure was 45 psi and 9.59 gal/acre of volume. Data were collected from random samples of 100 terminals, 100 squares, 100 flowers, and 100 bolls. Plots were machine-picked on 25 October 2005. Bidrin was applied on 24 July 2005 for plant-bug control on all plots at a rate of 0.5 lb ai/acre. Data were processed using Agriculture Research Manager Version 7. Analysis of variance and Duncan’s New Multiple Range Test (P=0.10) were conducted.

RESULTS AND DISCUSSION

In 2004 and 2005, trap counts were extremely low for budworm, and larval collections indicated field populations were cotton bollworm only.

In 2004, in the first three weeks of July cotton bollworm pressure was extremely high and the conventional plot was treated weekly during this period for three applications. WideStrike plots were treated 13 July (1X) and 20 July (2X). However, resulting data showed that little difference occurred in the WideStrike plots regardless of whether they were sprayed once or twice and therefore the data were merged as a single unit for reporting purposes. Seasonal percent damage (Fig. 2) indicated extremely high damage in the unsprayed portion of the plot compared to the sprayed conventional and WideStrike, sprayed or unsprayed. Damage to the conventionally sprayed was close to
that of unsprayed WideStrike. However, sprayed WideStrike had the least damage of all treatments. During the entire sampling period only 3 bollworms were observed and collected in the unsprayed WideStrike plot, the same was found in sprayed WideStrike. This was in contrast to 52 bollworm larvae in the unsprayed conventional and 9 bollworms in the sprayed conventional plots. At harvest, sprayed WideStrike and unsprayed WideStrike were not significantly different in terms of damage and had significantly higher yields than the conventional cotton (Fig. 2).

In 2005, small plots indicated treated plots had significantly less damaged fruit only for the PHY 410 R (conventional variety) in treated plots versus untreated, indicating excellent control of both bollworm and fall armyworm (Fig. 3). This same trend carried over into yield. Large-block trials indicated significantly higher rates of damaged fruit in the untreated conventional compared to WideStrike and all Bollgard II treatments (Fig. 4.). The untreated conventional variety yielded significantly less than all Bollgard II and WideStrike treatments. These studies indicate that Bollgard II and WideStrike provide a very high level of control of bollworm and fall armyworm.

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LITERATURE CITED


Fig. 1. Test design and observable worm damage in untreated areas.

Fig. 2. 2004 lint yields for WideStrike and conventional cotton.
Fig. 3. Seasonal damaged fruit for cultivars in small block study, 2005.

Fig. 4. Average seasonal damaged fruit in large block study, 2005.