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A TWO YEAR STUDY OF BOLLGARD II IN TN

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Abstract

Bollgard II cotton has hoped to deliver superior lepidopteran insect control over its Bollgard predecessor. Bollgard II cotton contains the same Bt gene, *Cry1Ac*, as Bollgard, plus an additional Bt gene, *Cry2Ab*. These two genes working together should improve control of all caterpillar insect species in the cotton belt. This study evaluated the efficacy of Bollgard II when compared to Bollgard and non-Bollgard sister lines. This study also evaluated each plot for lint yield comparisons with lepidopteran insect sprays compared to non-lepidopteran sprays, to determine the probability of achieving increased profits with over sprays. The research conclusions show the Bollgard II isoline to exhibit improved caterpillar insect control as well as comparable lint yield and quality. Although the results of this study show Bollgard II to be a superior heliothine product, more testing will be needed across a wide array of study acres in order to completely determine the efficacy and cost effectiveness of Bollgard II.

Introduction

Bollgard II cotton was commercially introduced in 2003 (Stewart 2004). Our initial sturdy of Bollgard II (Tritt and Burcham 2004) found the efficacy of the stacked gene cotton to be superior on the heliothine complex, however, many producers have considered the likelihood of achieving increased profits with Bollgard and non-transgenic varieties. This study evaluated the same varieties of cotton with different objectives. Our goal was to determine if efficient scouting and timely spray applications would generate increased profits for non-Bollgard and Bollgard varieties when compared to Bollgard II isolines. This study evaluated a side-by-side comparison of a split plot, randomized complete block design for two main regimens. One area would not be sprayed with a heliothine material during the growing season while the other area would be treated for the heliothine complex on an “as needed” basis.

Materials and Methods

A field study was conducted in West Tennessee during 2004 on a Grenada Silt Loam soil in Crockett County. The experiment was designed as a split plot, randomized complete block consisting of three treatments and three replications. Treatment replications consisted of cotton genotypes DPL 521 (non Bollgard sister line), DPL 215 (Bollgard) and DPL 424 (Bollgard II). Each plot consisted of eight rows planted on thirty-eight inch middles. Final plot design was as follows: 424, 215, 521, 521, 424, 215, 215, 424, 521, all untreated for the heliothine complex. The heliothine treated plot was as follows; 521, 424, 215, 215, 424, 521, 521, 215, 424.

All plots were planted on May 7 in a no-till environment. *Thiamethoxam* (Cruiser 5 FS, Syngenta Crop Protection, Inc., Greensboro, NC) was applied as a seed treatment at 7.65 fl oz/cwt for control of early season thrips.
The heliothine plots were treated on August 11 using *lambda cyhalothrin* (Karate Z 2.08 CS, Syngenta Crop Protection, Inc., Greensboro, NC) at 0.04 lb. a.i. per acre. The non-heliothine plots were treated on August 11 using *dicrotophos* (Bidrin 8WM, AMVAC Chemical Corporation, Los Angeles, CA) at .5 lb. a.i. per acre. Weed control, fertilization, plant growth regulation and defoliation were achieved by following University of Tennessee extension guidelines.

Bi-weekly insect scouting was conducted for each individual plot. Worm egg, bollworm/budworm larva, fall armyworm and beet armyworm larva numbers were achieved by examining one hundred consecutive plants, at two random locations, per plot. Examining one hundred consecutive bolls, at three random locations, per plot, derived Boll damage ratings. All data were subjected to ANOVA using PROC GLM (SAS Institute 1990), and means for each treatment were separated ($P \leq 0.05$) using Fisher’s Protected Least Significant Difference test.

Each plot was scouted bi-weekly after emergence and all plots were scouted separately. Scouting procedures followed guidelines set by the University of Tennessee Extension Service (Stewart and Lentz 2003.) During weekly scouting, all insects were recorded including harmful and beneficial insects. Careful attention was given to identification of lepidopteran pests, including visual sightings of moths, egg lay and larvae.

After performance of scouting procedures, decisions were made each week to determine if insects were at threshold levels. If insects were above economic threshold, then a spray was administered to the entire research area, based on the earlier mentioned heliothine complex criteria.

Each research plot was harvested on October 1, 2004. Each plot's weight was recorded in pounds of seed cotton per acre; Monsanto furnished a boll buggy with weigh scales. Plots of like varieties were put into the same cotton trailer to be evaluated for grade. Treatments were subjected to ANOVA using PROC GLM (SAS Institute 1990), and means for each treatment were separated ($P \leq 0.05$) using Fisher's Protected Least Significant Difference test.

Results and Discussion

There were no significant differences among genotypes with respect to yield. Although the Bollgard II variety yielded an average of twenty-four pounds per acre higher than the Bollgard variety and seventy pounds per acre higher than the non-Bollgard variety (Table 1.) Net return per acre was not significantly different among all three varieties with the Bollgard genotype returning twenty-four dollars an acre more than the Bollgard II variety and twelve dollars an acre more than the non-Bollgard variety (Table 2.) The increased dollar return for 215 was largely due to a superior staple (35) than either the 521 (34 staple) or the 424 (33 staple) varieties.

Two different spray regimens were also evaluated. Karate treated plots failed to consistently yield higher than the Bidrin treated plots and no significant differences were determined. 424 and 521 genotypes showed an average increase in yield when treated with Karate of twelve pounds and eight pounds respectively. 215 produced an average of ten pounds less when treated with Karate compared to the Bidrin treated plots. However, all plots exhibited less boll damage when treated with Karate compared to Bidrin (Table 3).

When comparing 2003 results with 2004, no distinct correlations can be made. In 2003, the Bollgard II variety was found to be equal in yield while being superior in grade and net return than either the Bollgard or non-Bollgard isolines. In 2004, the Bollgard II variety exhibited higher yields but had reduced quality. In 2004 both the non-Bollgard and Bollgard exhibited a higher return on investment than the Bollgard II variety. More testing will be necessary in order to determine the probability of Bollgard II increasing grower profits when compared to Bollgard and non-Bollgard varieties.

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Tables

Table 1. Lint yield per acre of non-Bollgard, Bollgard and Bollgard II cotton genotypes averaged across two treatments with three replications in West Tennessee, 2004.

Genotype	Mean Yield	Karate Mean	Bidrin Mean
Non-Bollgard	857 A	861 A	853 A
Bollgard	903 A	898 A	908 A
Bollgard II	927 A	932 A	920 A

Means with the same letter are not significantly different, Fisher's Protected LSD ($P \leq 0.05$)

Table 2. Net return per acre of non-Bollgard, Bollgard and Bollgard II cotton genotypes averaged across six replications in West Tennessee, 2004.

Genotype	Mean
Non-Bollgard	$459.00
Bollgard	$484.00
Bollgard II	$460.00

Table 3. Estimated mean numbers of worm damaged bolls produced under light populations by non-Bollgard, Bollgard and Bollgard II cotton genotypes averaged across two treatments with three replications in West Tennessee, 2004.

Genotype	Karate Mean	Bidrin Mean
Non-Bollgard	5.3 A	8.6 A
Bollgard	5.6 A	6.6 A
Bollgard II	2 B	3.6 A

Means with the same letter are not significantly different, Fisher's Protected LSD ($P \leq 0.05$)