BOLLGARD COTTON-UPDATE AND ECONOMIC COMPARISONS INCLUDING NEW VARIETIES

A. T. Wier
Monsanto
Cleveland, MS
J. Walt Mullins and Jane M. Mills
Monsanto
Memphis, TN

Abstract

Three years of on-farm comparison of Bollgard cotton have been conducted in several U.S. cotton production regions. These comparisons involved 5-10 acre plots of Bollgard compared to a grower selected standard. Bollgard varieties examined included NuCotn 33B, NuCotn 35B, and limited locations comparing newer Delta Pine and Paymaster Bollgard varieties.

In Mississippi, Bollgard out-yielded non-Bollgard cotton varieties examined by 92, 46, and 84 lbs. lint per acre on average in 1995, 1996, and 1997, respectively. After yields values and net returns were evaluated, Bollgard demonstrated a cost advantage of $82.50, $24.71, and $53.73 greater than in the non-Bollgard cotton in 1995, 1996, and 1997, respectively. Bollgard net return 3 year average for MS was $53.76 greater than for non-Bollgard.

Summaries of comparisons averaged over the 3 year period from 1995 through 1997 (1996 through 1997 for East Texas) demonstrate Bollgard yield advantages of 114, 45, and 54 lbs. lint per acre on average for the Southeast, Delta, and East Texas regions, respectively. Higher net returns also occurred in Bollgard cotton resulting in Bollgard advantages ranging from approximately $11 to $54 depending on the region evaluated.

Introduction

Three years of on-farm comparison of Bollgard cotton have been conducted that examined yield, insect control costs, net returns (yield value assuming $0.65 per lb. lint - control costs), and economic advantages. These comparisons have helped establish the value of Bollgard, not only as a replacement for insecticides applied for management of resistant tobacco budworm and bollworm, but as a pest management tool that can provide value above and beyond replacement of insecticide costs. This value can be realized in the form of increased net returns when yields and control costs are evaluated. These comparisons were conducted with the cooperation of agricultural consultants, state cotton specialists, and producers. This paper will summarize economic comparisons involving Bollgard and examine characteristics of Bollgard as a pest management tool, thresholds and pest management practices, proactive resistance management options, and resistance monitoring results.

Reprinted from the *Proceedings of the Beltwide Cotton Conference*
Volume 2:1039-1040 (1998)
National Cotton Council, Memphis TN

Discussion

Bollgard Cotton as a Pest Management Tool

Bollgard provides excellent control of tobacco budworm and pink bollworm and in many situations effectively manages cotton bollworm. However, high populations of cotton bollworm during bloom may reach damaging levels that warrant supplemental insecticide applications to optimize profitability. Because larvae must feed to consume a lethal dose of the toxin in Bollgard, supplemental treatments based solely on egg thresholds are generally discouraged. However, as a rule, Monsanto will support locally established scouting techniques and economic thresholds developed by local experts to fit specific, local conditions where Bollgard cotton is grown.

Bollgard cotton greatly reduces the risk of crop loss to major caterpillar pests and reduces the costs associated with management of resistant tobacco budworms or mixed populations including tobacco budworm, cotton bollworm, or pink bollworm. Bollgard cotton also has demonstrated higher net returns on average than non-Bollgard cotton in on-farm comparisons conducted in major U.S. cotton growing regions for 2-3 years.

Economic Comparisons of Bollgard

Bollgard has been compared to grower standard, non-Bollgard cotton varieties in on-farm trials involving 5-10 acre plots over a 2-3 year period (1995 under an experimental use permit, 1996 and 1997 in commercial production). The majority of these comparisons involved NuCotn 33B or NuCotn 35B. However, in 1997, limited comparisons were conducted involving newly developed Bollgard varieties including Delta Pine 20B, 32B, and 50B; and Paymaster 1215BG, 1220BG, 1244BG, and 1330BG. These data are averages across all plots. Insect control costs include the $32/acre technology fee. Cotton lint price of $0.65 per pound was assumed for calculation of net returns (yield value - insect control costs). Bollgard advantage values were calculated by subtracting the net returns for non-Bollgard from net returns of Bollgard.

In Mississippi, Bollgard has been evaluated under two extremes in pest pressure, extreme tobacco budworm pressure in 1995, and heavy bollworm pressure in 1996. Bollgard out-yielded the non-Bollgard cotton varieties examined by 92, 46, and 84 lbs. lint per acre on average in 1995, 1996, and 1997, respectively (Table 1). Cost of insect control in the non-Bollgard cotton plots also varied greatly in response to these different budworm/ bollworm pest spectrums. In 1995, costs of controlling insect pests in non-Bollgard cotton plots were approximately $23 greater than for Bollgard plots. While in 1996, costs of controlling

insect pests in non-Bollgard cotton plots were approximately $5 less than for Bollgard plots. After yields values and net returns were evaluated, these to extremes in pest pressure resulted in average net returns for producing Bollgard of $82.50 and $24.71 greater than in the non-Bollgard cotton (1995 and 1996, respectively). Tobacco budworm and cotton bollworm pest pressure generally was low to moderate in Mississippi in 1997, and costs of insect management in Bollgard ($84.42) and non-Bollgard ($82.55) plots were fairly similar this year. After evaluating yields and net returns for 1997, a Bollgard advantage ($53.73) very similar to the three year average ($53.76) for this state was observed.

Broad summaries were also compiled across three cotton production regions- the Southeast (AL, GA, FL), the Delta (MS, AR, LA), and East Texas (5 picker regions- Rio Grande Valley, Coastal Bend, Upper Gulf Coast, Brazos River Bottom, and the Blacklands). Results are averaged for the 3 year period from 1995-1997 (Table 2). However, data for East Texas was only available for 1996 and 1997. Yield advantages of 114, 45, and 54 lbs. lint per acre were observed on average for the Southeast, Delta, and East Texas regions, respectively (Table 3). Although insect control costs were higher for Bollgard in the Southeast and East Texas, yield values outweighed any control cost disadvantage. This resulted in higher returns in Bollgard cotton and Bollgard advantages ranging from $11 to $54 depending on the region evaluated.

Proactive Resistance Management

Bollgard cotton producers are required to sign a license agreement. One requirement of the license agreement involves planting a non-Bollgard refuge for resistance management. Specific guidelines for refuge options are outlined in the 'Monsanto Product Use Guide- Technical Information About Monsanto Technologies' available from Monsanto or your local seed retailer.

Basically there are two refuge options designed to proactively manage resistance of tobacco budworm, cotton bollworm, and pink bollworm to the toxin in Bollgard cotton. The first option (100:20 option) involves planting 20 acres of non-Bollgard cotton for each 100 acres of Bollgard cotton. For this option, the non-Bollgard cotton can be managed for all cotton pests with exception of use of foliar *Bacillus thuringiensis* insecticide products for control of lepidopteran pests. The second option (100:4 option) involves planting 4 acres of non-Bollgard cotton for every 100 acres of Bollgard cotton. Use of insecticides in the refuge for management of tobacco budworm, cotton bollworm, or pink bollworm is restricted for the 100:4 refuge option (refer to Monsanto product use guide for specific insecticides restrictions). All other pests should be managed in this refuge. Proper refuge management also involves use of necessary agronomic practices to ensure that the refuge develops similarly to the Bollgard cotton providing a suitable host for target pests.

Approximately 40% of U.S. Bollgard growers were visited by the Monsanto Resistance Management Team during 1997 and statistics on refuge choices and management are as follows. Approximately 66% of Bollgard producers we visited used the 100:20 refuge option, approximately 30% used the 100:4 option, and 4% used a combination of both options. Two percent of growers did not have a resistance management plan in place. This was due to reasons including crop failure, flooding, and lack of knowledge of refuge requirements. It also was evident that the refuge was not being properly managed on 2% of the farms visited. Of 183 Bollgard producers surveyed that used the 100:4 refuge option, we noted that 4.9% were suspected of not following the 4% refuge option guidelines by spraying the refuge for tobacco budworm or bollworm. Agronomic problems with the refuge were noted for less than 2% of the producers visited, and 1% conveyed that they would potentially abuse the guidelines for management of the 4% refuge.

Resistance Monitoring

Efforts to monitor resistance to the toxin in Bollgard cotton have been coordinated by the USDA-ARS Southern Insect Management Laboratory in Stoneville, MS. In 1997, collections of tobacco budworm and/or cotton bollworm were received from 9 states including AL, AR, FL, LA, GA, MS, NC, SC, and TX. Susceptibility of these collections were evaluated using a diet bioassay involving overlay of artificial diet with the foliar Bt insecticide MVPII that has the same active toxin as Bollgard. Results indicate that a general trend of no change in susceptibility of tobacco budworm or cotton bollworm to the toxin in Bollgard has occurred.

Summary

These comparisons have helped establish the value of Bollgard, not only as a replacement for conventional insecticides applied for management of resistant tobacco budworm and bollworm, but as a pest management tool that can provide value above and beyond replacement of insecticide costs. This value has been demonstrated in the form of greater net returns when yields and control costs are evaluated. Our long term goals for Bollgard cotton production and management should rely on a balance between optimizing profitability; reliance on sound pest management techniques (scouting, thresholds, and insecticides), and managing resistance.

Table 1. Summary of on-farm Bollgard comparisons conducted over 3 years in Mississippi.

	1995		1996		1997	
	Bollgard	non-BG	Bollgard	non-BG	Bollgard	non-BG
Lint Yield (lbs/AC)	969	877	894	848	984	900
Insect Control Costs $/Ac[1]	$71.31	$94.01	$63.35	$58.16	$84.42	$82.55
Return S/Ac[2]	$555.54	$476.04	$517.75	$493.04	$555.18	$501.45
Bollgard Advantage (S/AC)	$82.50		$24.71		$53.73	
MS Bollgard Advantage averaged over 3 years = $53.76						

[1]includes $32/Ac technology fee for Bollgard
[2](yield x $0.65 per lb. lint) - control costs.

Table 2. Summary of on-farm Bollgard comparisons averaged over 3 years for 3 cotton production regions.

	Southeast		Delta		East Texas[3]	
	Bollgard	non-BG	Bollgard	non-BG	Bollgard	non-BG
Lint Yield (lbs/AC)	933	819	964	919	543	489
Insect Control Costs $/Ac[1]	$46.131	$26.56	$79.99	$86.27	$65.61	$41.53
Return S/Ac[2]	$560.32	$505.79	$546.61	$511.08	$287.34	$276.32
Bollgard Advantage (S/AC)	$54.53		$35.53		$11.02	

[1]includes $32/Ac technology fee for Bollgard
[2](yield x $0.65 per lb. lint) - control costs
[3]1996 and 1997 only