SIX YEARS OF ECONOMIC COMPARISONS OF BOLLGARD® COTTON

Mark Oppenhuizen, J. Walt Mullins and Jane M. Mills
Monsanto Company
St. Louis, MO

Abstract

Beginning in 1995, one year before its commercial release, the economics of Bollgard cotton on the field scale have been examined by a number of investigators, including independent scientists and Monsanto. Many of these comparisons have been the results of researchers working over several years in one state or geography and have been reporting in the *Proceedings of the Beltwide Cotton Conference*. The results demonstrate that growers, on average, realize a significant Bollgard advantage, when using Bollgard cotton due to a combination of increased yields and decreased insect control costs. The economic advantage of Bollgard over conventional cotton production over the five-year test period in the independent trials was $49.80. This is consistent with the average advantage ($44.70) calculated for Bollgard from 485 economic comparisons sponsored by Monsanto over the period of 1995 to 2000. Data from Monsanto's 2000 field economic comparison trials (27 sites) gave an average Bollgard advantage of approximately $36 per acre.

Introduction

Economic comparisons of Bollgard cotton compared to conventional cotton and insect control programs have been conducted in many areas of the US cotton belt since Bollgard was introduced (ReJesus et. al., 1997; Stark, 1997; Weir et. al., 1998; Mullins and Mills, 1999; Bryant et. al., 1999; Seward et. al., 2000; Reed et. al., 2000; Karner et. al., 2000; Cooke et.al., 2000). These comparisons show that on average, growers benefit from Bollgard cotton due to increased yield, decreased insect control costs, or both. Monsanto has conducted economic comparisons since 1995 on 485 large plot or field situations resulting in a database covering a variety of growing and insect pressure conditions. Most of the studies show that even in years of light worm pressure where spray thresholds may not be reached, Bollgard provides higher yields than the conventional cotton, presumably because it is protecting bolls from damage even under light pressure. Results from Monsanto's 2000 economic comparisons are provided and used in the six-year review.

Materials and Methods

For the Monsanto field trials, grower fields were required to be in close proximity to one another, planted on or near the same date, and managed the same agronomically. All costs, particularly insect control costs, were recorded in the comparison of Bollgard to conventional varieties. Varieties from the same maturity grouping where used in all individual comparisons. Lint yields were recorded and yield value was calculated using $0.65 per lb. as the value of the lint. The Bollgard Tech Fee was based on the actual cost per acre when actual seed drop rates were below the 'standard' seed drop rates used to calculate the per bag Tech Fee.

Results

The Monsanto field comparisons are presented regionally in Tables 1-4 with an overall summary presented in Table 5. The data show that for all regions tested, the average Bollgard trial needed fewer total insect applications and had higher yields. The limited number of sites from the Southeast (GA/AL/FL) and east Texas prevent broader interpretation of the data from those regions, given that considerable variation in individual results was seen. For instance, in the three comparisons in east Texas, the number of total insecticide applications for conventional cotton varied from 0 to 13 sprays. In general, when averaged across all regions, Bollgard fields required 1.2 sprays for Tobacco Budworm or Cotton Bollworm, 3.0 sprays less than conventional fields, and the cost per spray for Bollgard fields was $2.01 less than a conventional field. Applications for budworm and bollworm to Bollgard fields can generally be made at lower rates or with less expensive insecticides to obtain control. The average cost for all insect control (including Bollgard Tech Fees and application costs) was $10.12 more expensive in conventional cotton than Bollgard. Lint yield increases with Bollgard cotton averaged from 17 to 129 lbs. across the four regions, with an overall average of 40 lbs. more lint across all sites tested. Combining the total insect control costs with the yield advantage resulted in an average Bollgard advantage of approximately $36 per acre overall. Because of the limited data from east Texas and the Southeast (GA/AL/FL) the summary averages shown in Table 5 are weighted more heavily towards the other two regions.

Tables 6-12 were developed from Bollgard economic comparisons to conventional varieties conducted by university scientists and reported in the *Proceedings of the Beltwide Cotton Conference*, 1997-2000. The 'Gross Dollar Return' was calculated based on the lint yield difference between Bollgard and conventional cotton and does not include any of the savings benefit from reduce insect control costs. The 'Net Dollar Return' is the sum of the total insect control costs and gross dollar return. This review includes only those studies that were conducted on large plots or farmer field situations where the Bollgard variety(s) was managed independently in terms of insect control from the conventional variety. In some of the studies below other differential costs were considered, e.g., growth regulants, harvest costs, etc., where the Bollgard variety differed from the conventional variety. In the great majority of these cases the Bollgard advantage was calculated by comparing yields and the differential insect control costs (includes Bollgard Tech fee), with all other input costs being the same between the Bollgard variety(s) and the conventional variety(s). Numbers in parenthesis indicate the economic advantage to the conventional variety. Table 13 contains an overall summary of the five years of third party comparisons, showing the Bollgard advantage for each year across all locations. For comparison, the Monsanto sponsored Bollgard economic comparison six year summary is included in Table 14.

Discussion

The results from the 2000 Monsanto sponsored trials and previous economic comparisons demonstrate that Bollgard provides value under a variety of growing and insect pressure conditions. Bollgard provides significant yield improvement by protecting more bolls from insect damage even under conditions of light worm pressure where spray thresholds have not been reached. Coupled with the savings in insect control costs that are seen in the majority of comparisons, Bollgard growers have a significant advantage over growers of conventional cotton.

The economic advantage of Bollgard over conventional cotton production over the five-year test period in the independent trials was $49.80 with an average yield increase of 10% over the nonBollgard comparisons. This is consistent with the average advantage ($44.70 and 7% increase) calculated for Bollgard from Monsanto sponsored trials. Clearly, the Bollgard advantage is related to insect pressure in a given season. However, it is apparent that even in very light insect years, such as 1997 and 1999, when insect control costs were higher in Bollgard cotton in some areas, there was an overall economic advantage due to higher yields in the Bollgard cotton. This consistent yield advantage, even in the light insect years, may be explained either by agronomic advantages of the Bollgard varieties and/or better insect control (including subthreshold control) with the Bollgard varieties.

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It should also be noted that even though in some years/locations that the total insect control costs were greater in the Bollgard cotton than in the conventional cotton, there was consistently less dollars spent on foliar insecticides, with fewer applications made on Bollgard. None of these studies accounts for any Bollgard value based on labor savings (with the exception of application costs) or environmental benefits. Additionally, there has been no assigned value to the risk management benefit or "peace of mind" factor associated with Bollgard cotton.

These averages do not mean that *any* Bollgard variety will provide economic benefits over *any* conventional variety, since yield is such an important factor in the total calculation of economic benefit. However, these studies do indicate that well adapted Bollgard or Bollgard/Roundup Ready varieties for a particular area will provide the producer with the best chance for the highest economic returns, regardless of the level of insect pest pressure.

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Table 1. Summary of 2000 Economic Comparisons Conducted in Georgia and Alabama (4 Comparisons).

Category (Average)	Conventional Variety	Bollgard Variety
No. BW/TBW Sprays*	2.5	0.5
Cost for Single BW/TBW Spray	$ 9.17	$ 9.85
Total BW/TBW Insecticide Costs	$ 24.20	$ 4.93
Total No. of All Insecticide Applic.	3.0	2.5
Total Insecticide Costs	$ 41.69	$ 28.29
Total Insect Control Costs**	$ 50.56	$ 58.97
Yield (Lb. Lint)	932	949 (+17)
Dollar Return	$554.92	$557.56
Bollgard Advantage		$2.64

*BW/TBW = Cotton Bollworm / Tobacco Budworm
**Includes Insecticide Costs, Application Costs & Tech Fee for Bollgard

Table 2. Summary of 2000 Economic Comparisons Conducted in North Carolina, South Carolina and Virginia (11 Comparisons).

Category (Average)	Conventional Variety	Bollgard Variety
No. BW/TBW Sprays*	3.7	1.6
Cost for Single BW/TBW Spray	$ 7.97	$ 7.83
Total BW/TBW Insecticide Costs	$ 27.42	$ 10.84
Total No. of All Insecticide Applic.	3.7	1.6
Total Insecticide Costs	$ 28.51	$ 11.97
Total Insect Control Costs**	$ 38.42	$ 38.28
Yield (Lb. Lint)	912	929 (+17)
Dollar Return	$554.20	$565.34
Bollgard Advantage		$ 11.13

*BW/TBW = Cotton Bollworm / Tobacco Budworm
**Includes Insecticide Costs, Application Costs & Tech Fee for Bollgard

Table 3. Summary of 2000 Economic Comparisons Conducted in East Texas (3 Comparisons).

Category (Average)	Conventional Variety	Bollgard Variety
No. BW/TBW Sprays*	3.0	0.3
Cost for Single BW/TBW Spray	$ 9.75	$ 17.35
Total BW/TBW Insecticide Costs	$ 27.21	$ 5.78
Total No. of All Insecticide Applic.	6.3	5.0
Total Insecticide Costs	$ 50.14	$ 34.55
Total Insect Control Costs**	$ 62.81	$ 63.29
Yield (Lb. Lint)	667	796 (+129)
Dollar Return	$370.53	$454.11
Bollgard Advantage		$ 83.58

*BW/TBW = Cotton Bollworm / Tobacco Budworm
**Includes Insecticide Costs, Application Costs & Tech Fee for Bollgard

Table 4. Summary of 2000 Economic Comparisons Conducted in Louisana and Mississippi (9 Comparisons).

Category (Average)	Conventional Variety	Bollgard Variety
No. BW/TBW Sprays*	5.8	1.2
Cost for Single BW/TBW Spray	$ 11.68	$ 5.73
Total BW/TBW Insecticide Costs	$ 67.20	$ 8.89
Total No. of All Insecticide Applic.	8.7	4.6
Total Insecticide Costs	$ 97.90	$ 41.54
Total Insect Control Costs**	$121.03	$ 86.96
Yield (Lb. Lint)	833	882 (+49)
Dollar Return	$420.27	$486.41
Bollgard Advantage		$ 66.14

*BW/TBW = Cotton Bollworm / Tobacco Budworm
**Includes Insecticide Costs, Application Costs & Tech Fee for Bollgard

Table 5. Summary of All 2000 Mid-South and Southeastern Economic Comparisons (Areas Combined - 27 Comparisons).

Category (Average)	Conventional Variety	Bollgard Variety
No. BW/TBW Sprays*	4.2	1.2
Cost for Single BW/TBW Spray	$ 9.59	$ 7.58
Total BW/TBW Insecticide Costs	$ 40.18	$ 8.75
Total No. of All Insecticide Applic.	5.6	3.1
Total Insecticide Costs	$ 56.00	$ 26.75
Total Insect Control Costs**	$ 70.47	$ 60.35
Yield (Lb. Lint)	861	901 (+40)
Dollar Return	$489.26	$525.52
Bollgard Advantage		$ 36.26

*BW/TBW = Cotton Bollworm / Tobacco Budworm
**Includes Insecticide Costs, Application Costs & Tech Fee for Bollgard

Table 6. Bollgard Advantage/(Disadvantage) of Third Party Economic Comparisons Conducted in Georgia.

Year	Number of Comparisons	Total Insect Control Cost ($)	% Lint Increase	Gross Dollar Return ($)	Net Dollar Return ($)
1996	14	27.50	11	72.80	100.30

Stark, 1997

Table 7. Bollgard Advantage/(Disadvantage) of Third Party Economic Comparisons Conducted in South Carolina.

Year	Number of Comparisons	Total Insect Control Cost ($)	% Lint Increase	Gross Dollar Return ($)	Net Dollar Return ($)
1996	2	42.78	NR	NR	11.62

ReJesus et. al., 1997
NR = Not Reported

Table 8. Bollgard Advantage/(Disadvantage) of Third Party Economic Comparisons Conducted in Mississippi – Hills and Delta.

Year	Number of Comparisons	Total Insect Control Cost ($)	% Lint Increase	Gross Dollar Return($)	Net Dollar Return ($)
1995	5	25.45	12	66.35	91.80
1996	5	(15.34)	7	40.50	25.16
1997	5	(4.34)	8	45.50	41.16
1998	5	4.00	18	79.30	83.30
1999	5	(14.66)	12	39.52	24.86
Average		(0.98)	11.4	54.23	53.26

Reed et. al., 2000

Table 9. Bollgard Advantage/(Disadvantage) of Third Party Economic Comparisons Conducted in the Mississippi Delta.

Year	Number of Comparisons	Total Insect Control Cost ($)	% Lint Increase	Gross Dollar Return($)	Net Dollar Return ($)
1997	14	(5.93)	(2)	(13.44)	(14.61)
1998	15	29.13	0	(2.59)	34.54
1999	13	(11.93)	2	18.67	1.23
Average		4.00	0	0.88	7.05

Cooke et. al., 2000

Table 10. Bollgard Advantage/(Disadvantage) of Third Party Economic Comparisons Conducted in Tennessee.

Year	Number of Comparisons	Total Insect Control Cost ($)	% Lint Increase	Gross Dollar Return($)	Net Dollar Return ($)
1998	9	(3.00)	12	55.25	52.25
1999	8	(19.00)	3	10.20	(9.00)
Average		(11.00)	8	32.73	21.63

Seward et. al., 2000

Table 11. Bollgard Advantage/(Disadvantage) of Third Party Economic Comparisons Conducted in Arkansas.

Year	Number of Comparisons	Total Insect Control Cost ($)	% Lint Increase	Gross Dollar Return($)	Net Dollar Return ($)
1996	6	(4.38)	NR	91.12	86.74
1997	7	(11.39)	NR	(15.56)	(26.95)
1998	7	10.22	NR	54.30	64.52
Average		(1.85)		43.29	41.44

Bryant et. al., 1999
NR = Not Reported

Table 12. Bollgard Advantage/(Disadvantage) of Third Party Economic Comparisons Conducted in Oklahoma.

Year	Number of Comparisons	Total Insect Control Cost ($)	% Lint Increase	Gross Dollar Return($)	Net Dollar Return ($)
1996	5	(13.25)	35	121.80	83.53
1997	16	(32.00)	9	73.80	46.45
1998	12	(26.34)	22	114.60	64.12
1999	14	(16.47)	19	77.50	40.06
Average		(22.02)	21	96.93	58.54

Karner et. al., 2000

Table 13. Bollgard Advantage/(Disadvantage) of Third Party Economic Comparisons Conducted Over Five years in the Mid-South and Southeast.

Year	Number ofTests	Number of Locations	% Lint Increase	Bollgard Advantage Net Dollar Return ($)
1995	1	5	12	91.80
1996	5	32	15	75.45
1997	4	42	4	12.72
1998	5	48	11	55.12
1999	4	40	9	13.90
Average			10	49.80

Table 14. Bollgard Advantage/(Disadvantage) from Monsanto Sponsored Trials in the Mid-South and Southeast.

Year	Number of Comparisons	Total Insect Control Cost ($)	% Lint Increase	Gross Dollar Return ($)	Net Dollar Return ($)
1995	23	22.70	10	59.80	82.50
1996	203	(5.19)	5	29.90	24.71
1997	94	(1.87)	9	54.60	53.73
1998	109	15.43	4	24.43	39.86
1999	29	(6.46)	7	37.20	31.12
2000	27	10.12	5	26.14	36.26
Average		5.79	7	38.68	44.70

Wier et. al., 1998; Mullins and Mills, 1999