





COMPARISON OF CONVENTIONAL AND TRANSGENIC COTTON IN ARKANSAS

*Kelly J. Bryant, William C. Robertson,
Gus M. Lorenz, Rob Ihrig, and George Hackman¹*

RESEARCH PROBLEM



The University of Arkansas, in cooperation with Arkansas cotton producers, county agents and industry representatives, has implemented side-by-side comparisons of Bollgard cotton varieties to non-*Bt* varieties each year since 1996. *Bt* and non-*Bt* varieties were grown in adjacent fields. Each variety was managed using Best Management Practices for that field and variety. Results indicate that *Bt* varieties have increased profit in most cases for the southern regions of the state but have not been profitable for the northern regions. Also, yields are the driving force in selecting the most economical cotton variety and/or technology.



BACKGROUND INFORMATION

The number of transgenic cotton varieties available for commercial production has increased greatly in recent years. Cotton producers now have multiple choices when choosing transgenic cotton varieties. The choice of variety now dictates the insect and weed control programs that will, or can, be used. Cotton varieties containing the Bollgard gene, the Roundup Ready gene, and the Buctril-resistant gene have been planted on a significant amount of Arkansas' cotton acreage since 1996. The success of these varieties has been mixed. The University of Arkansas, in cooperation with Arkansas cotton producers, county agents, and industry representatives, has implemented side-by-side comparisons of Bollgard cotton varieties to non-*Bt* varieties each year beginning in 1996. This manuscript presents the economic results of these comparisons. Partial budgeting was used to account for any differences in management

¹ Area extension specialist - Farm Management, University of Arkansas, Southeast Research and Extension Center, Monticello; extension agronomist - cotton and extension entomologist, University of Arkansas Cooperative Extension Service, Little Rock; Roundup cotton specialist, Monsanto Co., Collierville, TN; and agronomic systems manager, Monsanto Co., Tumbling Shoals.

and to assess the change in profit associated with growing the *Bt* variety rather than the non-*Bt* variety.

RESEARCH DESCRIPTION

In each of several Arkansas counties, a cotton variety containing the *Bt* gene was planted adjacent to a non-*Bt* cotton variety in order to compare cost and return differences. In 1996, the Delta and Pine Land (D&PL) variety NuCOTN 33B was compared primarily to other D&PL varieties. In subsequent years, DP NuCOTN 33B was compared to non-*Bt* varieties from other seed companies considered to be the best conventional varieties for the production region. As additional *Bt* and stacked gene varieties became available, the best (or most popular) varieties containing the *Bt* gene were compared to the best (or most popular) non-*Bt* varieties. Fields were chosen that were very similar in nature. Each field was managed using Best Management Practices for that field and variety. The primary differences in management between the two fields being compared in each observation involved insect and weed control due to the transgenic properties of the varieties involved.

Partial budgeting was used to account for any differences in management and to assess the change in profit associated with growing the *Bt* variety rather than the non-*Bt* variety. Input prices paid by the cotton producer were used when available. Otherwise, input prices listed in the cotton budgets were used (Bryant and Windham, 2001). When farmers provided information on prices received for cotton yield from the varieties being compared, those cotton prices were used. Otherwise, season average prices obtained from the Arkansas Agricultural Statistic Service in that year were used (Anonymous, 1996-2000). These prices were \$0.71/lb, \$0.66/lb, \$0.68/lb, \$0.60/lb, \$0.568/lb, and \$0.52/lb for 1996 through 2001, respectively. When cotton grades for the varieties being compared were available, premiums or discounts were added to these prices using the CCC loan values table for the year in question.

RESULTS

The partial budgeting results are displayed in Tables 1-5. The forty comparisons in all are grouped by region and listed by year. The “change in gross return” column lists the changes in gross returns associated with growing the *Bt* variety instead of the non-*Bt* variety. This change in returns is the result of the yield difference between the two varieties and, in some cases, price differences due to cotton grade. Changes in gross return are mostly positive in the southern regions of the state (Tables 1 and 2); both positive and negative in south central Arkansas (Table 3); and mostly negative in the northern regions of the state (Tables 4 and 5). Across all forty observations, the average change in gross return was a positive \$9.70/acre.

The “change in variable cost” column lists the changes in variable cost associated with growing the *Bt* variety instead of the non-*Bt* variety. These changes are the result of differences in seed costs, technology fees, herbicide programs, and insecticide programs. The change in variable cost is mostly negative in southeast Arkansas (Table 2) indicating that the *Bt* varieties reduce variable cost in this region. The other regions (Tables 1, 3, 4, and 5) indicate mostly increases in variable costs associated with growing the *Bt* varieties. Across all forty observations, the average change in variable cost was a negative \$3.37/acre.

The “change in profit” column lists the changes in profit associated with growing the *Bt* variety instead of the non-*Bt* variety. These changes in profit are the result of the changes in gross returns and the changes in variable costs. Changes in profit are mostly positive in the southern regions of the state (Tables 1 and 2); both positive and negative in south central Arkansas (Table 3); and mostly negative in the northern regions of the state (Tables 4 and 5). Across all forty observations, the average change in profit was a positive \$13.06/acre.

PRACTICAL APPLICATION

Economic comparisons of *Bt* to non-*Bt* cotton varieties in Arkansas indicate that *Bt* varieties have increased profit in most cases for the southern regions of the state, but have not been profitable for the northern regions. *Bt* varieties in south-central Arkansas have effected neither an increase nor a decrease in profit. In a large majority of the cases, regardless of region, a positive change in gross return results in a positive change in profit. Thus we can conclude that yields are the driving force in selecting the most economical cotton variety and/or technology, and that costs are of secondary importance.

LITERATURE CITED

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Table 1. Field observations on returns, costs, and profits comparing Bollgard (BG) cotton to non-Bt varieties. Southwest Arkansas (Lafayette Co.), 1996-1999.

Year	BG variety	Non-Bt variety	Change in gross return ^z	Change in variable cost ^z	Change in profit ^z
1996	DP NuCOTN 33B	DP 5415	\$58.22	(\$10.16)	\$68.38
1997	DP NuCOTN 33B	SG 125	\$68.64	\$13.63	\$55.01
1998	DP NuCOTN 33B	DP 20	\$91.80	\$24.97	\$66.83
1999	DP NuCOTN 33B	DP 51	\$31.20	\$14.94	\$16.26
Average			\$62.47	\$10.85	\$51.62

^z A positive number indicates that the value was greater for the *Bt* variety while a negative number, in parentheses, indicates that the value was less for the *Bt* variety compared to the non-*Bt* variety.

Table 2. Field observations on returns, costs, and profits comparing Bollgard (BG) cotton to non-Bt varieties. Southeast Arkansas (Desha and Lincoln Counties), 1997-2001.

Year	BG variety	Non-Bt variety	Change in gross return ^z	Change in variable cost ^z	Change in profit ^z
1997	DP NuCOTN 33B	DP 5409	\$116.16	(\$18.21)	\$134.37
	DP NuCOTN 33B	SG 501	\$18.48	(\$17.31)	\$35.79
	DP NuCOTN 33B	DP 5415	(\$58.08)	(\$8.04)	(\$50.04)
1998	DP NuCOTN 33B	DP 5415	\$189.72	(\$61.24)	\$250.96
	STV 4740BG	STV 373	\$118.32	(\$2.99)	\$121.31
	STV 4740BG	STV 373	\$79.56	(\$2.99)	\$82.55
1999	Three variety avg. ^y	Three variety avg. ^x	\$325.14	(\$8.40)	\$333.54
2000	DP 451 B/RR	SG 747	\$6.47	(\$97.14)	\$103.61
	DP 451 B/RR	PSC 355	\$42.04	(\$6.73)	\$48.77
2001	DP 451 B/RR	STV BXN47	(\$17.69)	(\$96.37)	\$78.69
Average			\$82.01	(\$31.94)	\$113.95

^z A positive number indicates that the value was greater for the *Bt* variety while a negative number, in parentheses, indicates that the value was less for the *Bt* variety compared to the non-*Bt* variety.

^y The yields and grades of three varieties, DP 451B/RR, SG 125B/R, and PM 1220BG/RR, were averaged.

^x The yields and grades of three varieties, DP 5111, SG 747, and ST 474, were averaged.

Table 3. Field observations on returns, costs, and profits comparing Bollgard (BG) cotton to non-Bt varieties. South central Arkansas (Jefferson and Phillips counties), 1996-2000.

Year	BG variety	Non-Bt variety	Change in gross return ^z	Change in variable cost ^z	Change in profit ^z
1996	DP NuCOTN 33B	DP 20	\$207.32	\$3.03	\$204.29
	DP NuCOTN 33B	DP 5409	\$189.57	\$10.33	\$179.24
	DP NuCOTN 33B	SG 125	\$76.86	\$5.71	\$70.97
	DP NuCOTN 33B	SG 125	(\$9.23)	\$2.73	(\$11.96)
1997	DP NuCOTN 33B	SG 125	\$10.56	\$32.76	(\$22.20)
	DP NuCOTN 33B	STV 474	(\$153.78)	\$12.87	(\$166.65)
	DP NuCOTN 33B	SG 125	(\$110.88)	\$64.02	(\$174.90)
1998	DP 50BG	STV BXN47	(\$4.76)	\$0.34	(\$5.10)
1999	DP 20B	STV BXN47	(\$206.40)	(\$8.90)	(\$197.49)
2000	ST 4892 BG/RR	PSC 355	(\$54.76)	(\$35.00)	(\$19.76)
	PM 1218 BG/RR	SG 747	\$136.86	\$0.52	\$136.34
Average			\$7.40	\$8.04	(\$0.66)

^z A positive number indicates that the value was greater for the *Bt* variety while a negative number, in parentheses, indicates that the value was less for the *Bt* variety compared to the non-*Bt* variety.

Table 4. Field observations on returns, costs, and profits comparing Bollgard (BG) cotton to non-Bt varieties. Central Arkansas (Crittenden, St. Francis, and Lonoke Counties), 1996-2001.

Year	BG variety	Non-Bt variety	Change in gross return ^z	Change in variable cost ^z	Change in profit ^z
1996	DP NuCOTN 33B	DP 5415	\$58.22	(\$10.16)	\$68.38
1996	DP NuCOTN 33B	DPL 5415	\$24.14	\$14.62	\$9.52
1998	Variety Demo	STV 373	(\$129.20)	(\$22.75)	(\$106.45)
1999	PM 1560 BG	ST BXN 47	(\$59.89)	\$58.82	(\$118.71)
	Three variety avg. ^y	Three variety avg. ^x	\$48.80	\$0.97	\$47.83
	Three variety avg. ^y	Three variety avg. ^x	\$15.91	\$29.51	(\$13.60)
	Three variety avg. ^y	Three variety avg. ^x	(\$305.82)	(\$34.65)	(\$271.17)
2000	PM 1218 BG/RR	PSC 355	\$46.13	(\$35.42)	\$81.55
	ST 4892 BG/RR	ST BXN 47	(\$11.93)	\$42.47	(\$54.40)
	PM 1218 BG/RR	PSC 355	\$31.42	(\$82.82)	\$114.06
2001	PM 1218 BG/RR	SG 105	(\$67.41)	\$20.10	(\$87.51)
	DP 451 B/RR	PM 1199 RR	(\$82.17)	(\$4.50)	(\$77.67)
	PM 1218 BG/RR	PM 1199 RR	(\$86.86)	\$11.11	(\$97.97)
Average			(\$48.09)	(\$0.21)	(\$47.88)

^z A positive number indicates that the value was greater for the *Bt* variety while a negative number, in parentheses, indicates that the value was less for the *Bt* variety compared to the non-*Bt* variety.

^y The yields and grades of three varieties, DP 451B/RR, SG 125B/R, and PM 1220BG/RR, were averaged.

^x The yields and grades of three varieties, DP 5111, SG 747, and ST 474, were averaged.

Table 5. Field observations on returns, costs, and profits comparing Bollgard (BG) cotton to non-*Bt* varieties. Northeast Arkansas (Craighead and Mississippi Counties), 1999-2000.

Year	BG variety	Non- <i>Bt</i> variety	Change in gross return ^z	Change in variable cost ^z	Change in profit ^z
1999	Three variety avg. ^y	Three variety avg. ^x	(\$82.24)	\$39.71	(\$121.95)
2000	PM 1218 BG/RR	ST BXN 47	(\$45.08)	(\$4.42)	(\$40.66)
	PM 1218 BG/RR	ST BXN 47	(\$59.07)	\$20.11	(\$79.18)
Average			(\$62.13)	\$18.47	(\$80.60)

^z A positive number indicates that the value was greater for the *Bt* variety while a negative number, in parentheses, indicates that the value was less for the *Bt* variety compared to the non-*Bt* variety.

^y The yields and grades of three varieties, DP 451B/RR, SG 125B/R, and PM 1220BG/RR, were averaged.

^x The yields and grades of three varieties, DP 5111, SG 747, and ST 474, were averaged.