A TWO YEAR AGRONOMIC EVALUATION OF CONVENTIONAL AND TRANSGENIC BT COTTON CULTIVARS IN THE MISSISSIPPI DELTA

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Abstract

While utilizing cotton IPM practices, over 20 mid-south cotton varieties were examined across different growing conditions for yield and lint quality during 1999 and 2000. An early-season variety (DP20B) was the highest yielding variety for both years. Based on yield, these data indicate that many commercially available varieties differed significantly from one another while some varieties were discounted for high micronaire. Furthermore, transgenic Bt cotton varieties significantly out-yielded non-Bt varieties by 94 lb lint/A during 2000. It is hoped that this information will be useful to the cotton grower for future cultivar selections in the mid-south.

Introduction

In 1996 the first U.S. transgenic Cry1Ac *Bacillus thuringiensis* Berliner (Bt) cotton variety (Bollgard®, Monsanto Ag. Co., St. Louis, MO) was widely commercialized. Since introduction to the cotton grower, there have been numerous advancements for pest control with transgenic technology. Where once a single variety contained a single insecticidal gene, growers can now choose from over 30 transgenic varieties. These varieties can contain the Cry1Ac gene, a herbicide-resistance gene, or both. Because the number of transgenic cotton varieties being developed annually is increasing, evaluation of varieties that best suit specific geographical regions and growing conditions is becoming increasingly important. Our purpose was to evaluate varieties across a number of common growing conditions for the mid-south while practicing local pest management procedures.

Materials and Methods

1999

Plots. Twenty-four mid-south varieties (eight conventional and sixteen transgenic) were planted in experimental plots on 24 May at Elizabeth, MS. Plots consisted of 4 rows (40" centers) x 100' treatments arranged in a randomized complete block design with each variety replicated twice in each field (Field 1=Silty-loam and Field 2=Clay soil).

Treatments. At planting, all plots received *Temik15G* (Aventis) and *Terrachlor SuperX* (Uniroyal) at 4.0 lb/A and 6.0 lb/A, respectively. All plots were treated conventionally with herbicides and insecticides; however, no insecticide treatments were applied to control Lepidoptera in the Bt varieties and *Round-up* (Monsanto Ag. Co.) was not applied to the *Round-up Ready* varieties (Table 1). All varieties were treated with *Pix* (BASF Corporation) at 8.0 oz/A (two application of 4.0 oz/A) and received *Urea* (applied in two aerial applications of 120 total units).

Yield and Lint Quality. All varieties were harvested on 13 October using a two row plot picker. A sample size of 200'/variety/field (seed cotton) was harvested. Lint/A was based on 35% gin turnout. All harvested samples were ginned at the USDA-ARS Ginning Laboratory, Stoneville, MS and classing results were completed at the USDA-AMS Cotton Division, Dumas, AR Classing Office.

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2000

Plots. Twenty-seven mid-south varieties (fifteen conventional and twelve transgenic) and two stripper varieties (one Round-up ready and one Bt/Round-up ready) were planted in experimental plots on 16 May at Elizabeth, MS. Plots consisted of 4 rows (40" centers) x 100' treatments arranged in a randomized complete block design with each variety replicated three times in each field (Field 1=Silty loam, Field 2=Clay soil and Field 3=Irrigated Clay soil).

Treatments. At planting, all plots received *Temik15G* (Aventis) and *Terrachlor SuperX* (Uniroyal) at 4.0 lb/A and 6.0 lb/A, respectively. All plots were treated conventionally with herbicides and insecticides; however, no insecticide treatments were applied to control Lepidoptera pest in the Bt varieties and *Round-up* (Monsanto Ag. Co.) was not applied to the *Round-up Ready* varieties (Table 2). All varieties were treated with *Pix* (BASF Corporation) at 8.0 oz/A (two applications of 4.0 oz/A), received *Urea* (applied in two aerial application of 150 total units), and treated for cotton boll weevils by the Mississippi Boll Weevil Eradication Program (first year for Region I). Field 3 (Irrigated Clay soil) was furrow-irrigated twice (7/19 and 8/7).

Yield and Lint Quality. All varieties were harvested on 29 September using a two row plot picker. A sample size of 200'/variety/field (seed cotton) was harvested. Lint/A was based on 35% gin turnout. All samples were ginned at the USDA-ARS Ginning Laboratory, Stoneville, MS on 5 December 2000 and will be sent to the USDA-AMS Cotton Division, Dumas, AR Classing Office for classing results.

Statistics. Yield means were analyzed using PROC MIXED (Littell et al. 1996). Contrasts for conventional versus transgenic varieties also were conducted using PROC MIXED.

Results and Discussion

1999

Unusually hot and dry conditions in July and August resulted in a short growing season. In addition, low natural infestations of Lepidoptera occurred in all plots. DP20B was the highest yielding variety followed closely by DP448B and DP50B. Yields ranged from a high of 933 lb lint/A (DP20B) to a low of 615 lb lint/A (PM1215BG), a difference of 318 lb lint/A. Furthermore, nine varieties were deducted for high micronaire (Table 3).

2000

Similar weather conditions to the 1999 season occurred, although we did experience slightly higher Lepidoptera infestations. DP20B again was the highest yielding variety. Yields ranged from a high of 940 lb lint/A (DP20B) to a low of 609 lb lint/A (PM952), a difference of 331 lb lint/A, again similar to 1999 (Table 4). In addition, Bt varieties out yielded non-Bt varieties by 94 lb of lint/A ($F=20.59$; $df=1, 211$; $P < 0.001$). Lint yield from the 1999 and 2000 trials were consistent for varieties duplicated with the exception of DP428B and DP5415RR (Table 5).

Examining cotton varieties across a number of common growing conditions will provide farmers with critical information on varietal selections. We hope to continue to evaluate numerous varieties on lint quality and yield while practicing both available and experimental integrated pest management strategies.

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References Cited

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Disclaimer

Mention of a commercial or propriety product does not constitute an endorsement by the U.S. Department of Agriculture for its use.

Table 1. Insecticide applications (1999).

Date	Plots Treated	Insecticide & Rate[a]	Target Pest
5/24	All	*Temik* @ 4.0 lb /A	Thrips
7/2	All	*Provado* @ .047 lbai /A & *Malathion* @ 0.94 lbai /A	Aphids, TPB & BW
7/23	All	*Orthene* @ 0.50 lb /A & *Comite* @ 1.23 lbai /A	TPB & Mites
8/4	All	*Malathion*[b] *ULV* @ 10.0 oz/A	BW & TPB
8/11	Non-Bt	*Curacron* @ 1.0 lbai /A	TBW & CBW

[a] Insecticide applied using a JD 6000 Hi-Cycle calibrated to broadcast 6.0 gal/A.
[b] Mississippi Boll Weevil Eradication Program, fall diapause treatments.
TPB=Tarnished Plant Bug, BW=Boll Weevil, CBW=Cotton Bollworm, TBW=Tobacco Budworm= *Bacillus thuringiensis*, Bt Cotton.

Table 2. Insecticide applications (2000).

Date	Plots Treated	Insecticide & Rate[a]	Target Pest
5/16	All	*Temik* 15G @ 4.0 lb/A & *Ammo* @ .025 lbai/A	Thrips & CW
6/10	All	*Malathion*[b] @ 10.0 oz/A	BW
6/14	All	*Vydate* @ 0.25 lbai/A	TPB
6/20	All	*Malathion* @ 10.0 oz/A	BW
6/24	All	*Malathion* @ 10.0 oz/A	BW
7/1	All	*Malathion* @ 10.0 oz/A	BW
7/13	Bt	*Vydate* @ 0.25 lbai/A	TPB
7/13	Non-Bt	*Vydate* @ 0.25 lbai/A & *Tracer* @ .067 lbai/A	TPB, TBW & CBW
7/15	All	*Malathion* @ 10.0 oz/A	BW
7/26	All	*Monitor* @ 0.25 lbai/A & *Ovasyn* @ 0.50 lbai/A	WF & Mites
8/1	All	*Monitor* @ 0.25 lbai/A & *Ovasyn* @ 0.50 lbai/A	WF & Mites
8/4	Non-Bt	*Tracer* @ .089 lbai/A	TBW & CBW
8/6	Non-Bt	*Curacron* @ 0.50 lbai/A & *Orthene90S* @ 0.50 lb/A	TBW, CBW, WF & TPB
8/17	Bt	*Provado* @ .047 lbai/A	WF & TPB
8/18	All	*Malathion* @ 10.0 oz/A	BW
9/6	All	*Malathion* @ 10.0 oz/A	BW

[a] Insecticide applied using a JD 6000 Hi-Cycle calibrated to broadcast 6.0 gal/A.
[b] First year of Mississippi Boll Weevil Eradication Program, Region I.
CW=Cutworm, BW=Boll Weevil, TPB=Tarnished Plant Bug, WF=Whiteflies, TBW=Tobacco Budworm , CBW=Cotton Bollworm, Bt=*Bacillus thuringiensis* Cotton.

Table 3. Yield and fiber quality (1999).

Variety	Lint Yield	Micronaire[a]	Length[b]/Staple	Strength[c]
DP20B	933	44	109/35	28.4
DP448B	910	46	110/35	28.8
DP50B	910	47	112/36	29.8
PM1330BG	876	43	111/36	30.7
DP422B/RR	865	45	108/35	27.4
DP429RR	820	47	107/34	28.5
DP32B	820	44	108/35	30.1
DP409B/RR	808	45	108/34	28.3
DP451B/RR	808	50*	109/35	28.3
DP425RR	785	52*	109/35	27.4
DP5415RR	774	51*	110/36	30.2
DP458B/RR	763	51*	110/35	30.3
DP33B	762	48	110/36	30.0
DP388	740	48	107/34	29.3
DP436RR	740	50*	110/36	28.9
DP5415	706	51*	110/36	30.0
PM1244BG	706	37	110/35	30.7
PM1220BG/RR	694	47	108/35	29.6
DP428B	671	48	109/35	26.9
PM1220RR	660	43	109/35	31.0
DP90B	660	50*	110/36	32.3
DP5111	649	50*	107/34	30.9
PM1560BG	626	51*	109/35	32.1
PM1215BG	615	41	112/36	30.5

Lint yield is based on 35% gin turn-out. Std error is 88.75. Mississippi average yield was 704 lb lint/A.
DP=Delta & Pineland, PM=Paymaster (Delta & Pineland).
B or BG=Bollgard, RR=Round-up Ready, B or BG/RR=Bollgard & Roundup-Ready.
[a] Discount range is below 35 and above 50. *Discounted micronaire.
[b] Below 105 is discounted.
[c] Below 25.5 is discounted and above 29.5 is a premium.

Table 4. Yield and Fiber Quality (2000).

Variety	Lint Yield	Std Error
DP20B	940	58.46
DP428B	878	58.46
DP422B/RR	875	58.46
DP50B	866	58.46
SG125B/RR	863	58.46
ST4691B	852	58.46
DP451B/RR	832	58.46
DP436RR	831	62.01
DP51	827	62.01
PM1218B/RR	821	58.46
DP50	818	62.01
DP33B	810	58.46
SG747	799	62.01
DP409B/RR	790	58.46
ST474	776	62.01
ST4892B/RR	760	58.46
PHY355	746	62.01
DP388	745	62.01
DP5415	743	62.01
DP425RR	742	62.01
DP458B/RR	742	58.46
DP5409	732	62.01
PM2280B/RR*	725	58.46
DP429RR	721	62.01
SG125	706	62.01
DP5415RR	664	62.01
DP5690	650	62.01
PM2200RR*	619	62.01
PM952	609	62.01
Non-Bt	733	62.01
Bt	827	58.46

Lint yield based on 35% gin turn-out. Mississippi average yield was 649 lb lint/A.
DP=Delta & Pineland, SG=Sure Grow (Delta & Pineland), PM=Paymaster (Delta & Pineland), ST= Stoneville Seed Co., PHY= Phytogen (Dow AgroSciences)
B= Bollgard, RR=Round-up Ready, B/RR= Bollgard & Roundup-Ready. Bt= *Bacillus thuringiens*
***Stripper variety (for cluster analysis purposes).**

Table 5. Yield comparisons (1999 – 2000).

Variety	1999 Lint Yield	2000 Lint Yield	Difference
DP20B	933	940	7
DP428B	671	878	207
DP422B/RR	865	875	10
DP50B	910	866	44
DP451B/RR	808	832	24
DP436RR	740	831	91
DP33B	762	810	48
DP409B/RR	808	790	18
DP388	740	745	5
DP5415	706	743	37
DP425RR	785	742	43
DP458B/RR	763	742	21
DP429RR	820	721	78
DP5415RR	774	664	110

Lint yield based on 35% gin turn-out.
DP=Delta & Pineland, B=Bollgard, RR=Round-up Ready, B/RR=Bollgard & Round-up Ready.