

YIELD, QUALITY, COSTS, AND NET RETURNS: THREE-YEAR SUMMARY COMPARING CONVENTIONAL AND TRANSGENIC COTTON VARIETIES

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Introduction

In 2004, 96% of Georgia cotton acreage was planted to transgenic varieties (USDA-AMS, 2004). Georgia farmers planted 1.29 million acres in 2004 and of this total, 81% were “stacked gene” (BR) varieties, and 14% were “Round-up Ready” (RR) varieties. Smaller quantities of other technologies such as BIIR (Bollgard II) and LL (Liberty Link) were planted.

Growers continue to rely heavily on Round-up Ready technology although in recent years, Georgia growers have trended away from straight RR and toward BR technology. The profitability of these various “systems” depends on comparative yields, fiber quality, seed cost including technology fees, herbicide and insecticide costs depending on the need in any year or over a period of years, and labor use/savings.

Methodology

A study began in 2001 to conduct a “systems trial” – a trial where each variety was managed (produced) according to its’ prescribed technology. Herbicides and insecticides would be applied in accordance with the technology and based on University of Georgia Cooperative Extension Service recommendations. Further, in addition to yield, fiber quality measurements were obtained and net returns calculated for each variety and by system.

Each year, the varieties were planted in a randomized, complete block design with 4 replications of each variety. The center 4 rows of each plot were machine picked and seed cotton weighed. Two random samples from each plot were combined and sent to the USDA-ARS Cotton Ginning Laboratory in Stoneville, MS for ginning and lint turn-out and fiber quality determined.

Seed cost (including technology fees) typical for Georgia farmers was determined each year from prices given by seed company sales representatives. Cost per acre was based on 36-inch rows and 3 seed per foot of row. Herbicide and insecticide costs were calculated from prices obtained annually by a sample survey of input supply dealerships. System costs included seed, technology fee if applicable, herbicides, insecticides, and application costs (machinery, equipment, and labor). All other inputs

and costs were the same for each treatment and thus not relevant.

Total income was lint plus cottonseed. Each year, lint was valued at the November average cash price for the quality of the sample plus LDP (Loan Deficiency Payment), if applicable. Cottonseed was valued at the November average Georgia price received for that year. Net return was calculated for each replication of each variety. The Net return was then averaged for each variety and then for each technology type. Net return for each variety and technology was calculated as:

$$NR_{xy} = (Y_x \times LP_{qx}) + (C_x \times SP) - S_{xy} - H_y - I_y - A_y$$

NR = the Net Return above system costs for variety x, technology y

Y = lint yield (lbs per acre) for variety x

LP = the November price/lb of lint adjusted for quality (q) for variety x (includes LDP)

C = the cottonseed yield for variety x calculated from lint turn-out data

SP = the November average Georgia price received by farmers for cottonseed

S = seed cost per acre for variety x, technology y based on 3 seed per foot

H = herbicide costs per acre for technology y

I = insecticide costs per acre for technology y

A = herbicide and insecticide application cost per acre for technology y

Results

Study results each year by variety and technology (C is conventional or non-transgenic, B is Bollgard or Bt, R is Roundup Ready and BR is stacked) are summarized in Tables 1A through 3B. The mean yield, gin lint turnout and seed yield, price per pound based on fiber quality parameters, income, systems costs, and net return is shown by variety and by system (all varieties within a system averaged). Note that the mean yield of the highest yielding varieties may be numerically different but not statistically different.

In 2001, non-Bt cottons needed no worm controls. Insecticide cost was the same regardless of system. Herbicide cost was \$4.40 per acre higher for the non-RR varieties. The highest quality premiums were received for FM 989, FM 966B, DP 555BR, FM 989BR, PSC GA161, and Delta Pearl. The highest yielding conventional variety was FM 989. Four of the top 5 yielding varieties were Bt or BR. Four of the lowest 5 yielding varieties were RR. Numerically, highest net return was ST 4691B at \$804.56 per acre. By technology group, the BR system produced the highest net return of \$754.58 per acre followed closely by the Bt system. Seed cost, including technology fee, averaged \$9.32 per acre for conventional, \$18.29 per acre for Roundup Ready, \$38.68 per acre for Bt, and \$45.13 per acre for “stacked” (BR).

In 2002, worm pressure required additional sprays on non-Bt cotton. Insecticide costs were \$9.62 per acre higher for non-Bt cottons. As in 2001, herbicide cost again was higher for non-RR cotton. Conventional and Bt cottons were \$5.55 per acre higher. In 2002, numerically the top 5 yielding varieties were conventional (3 varieties) and BR (2 varieties). Numerically, the highest yielding and highest net return variety was FM 989

followed by DP 555BR. The highest premiums for quality were received for FM 989, PSC GA161, and FM 991RR. Three of the lowest 5 yielding varieties were Roundup Ready (RR). Seed cost, including technology fee, averaged \$11.30 per acre for conventional, \$21.66 per acre for RR, \$37.62 per acre for Bt, and \$50.93 per acre for BR.

In 2003, Bollgard II “stacked” (BIIR) and Liberty Link (LL) technologies were added to the trial and Bt was deleted due to declining acreage and importance in the state. There were 2 BIIR varieties planted, DP 424 BIIR and ST 4646 BIIR. Only one LL variety was planted- FM966LL. In 2003, insecticide costs were \$23.10 per acre higher for the non-Bt cottons (conventional, and LL). Non-Bt cottons were sprayed 3 times for worms. Bt cottons (BR and BIIR) received spray for stink-bug control only. Herbicide costs were \$27.91 per acre for conventional and slightly higher at \$29.22 per acre for RR and \$29.46 per acre for LL. Numerically, the highest yielding variety was DP 555BR followed by FM 966LL. Generally, the Bollgard II cotton’s were not among the highest yielding varieties. The highest prices for quality were achieved by DP 491, DP 494R, Delta Pearl, and PSC GA 161. By technology group, the Liberty-Link technology had the highest net return at \$781.66 per acre followed by conventional at \$710.40 per acre. Seed cost, including technology fee, averaged \$15.57 acre for conventional, \$26.72 per acre for LL, \$29.67 per acre for RR, \$61.29 per acre for BR, and \$68.89 per acre for BIIR.

Summary

The comparative profitability of various seed technologies depends, among other factors, on yield, price (as impacted by fiber quality), seed and technology fee cost, and herbicide and insecticides costs including application. With regard to seed/tech fee vs. herbicide and insecticide costs, these costs substitute one for another and profitability depends on the incidence and degree of pest and weed problems. Growers must also consider other factors, however, including labor savings and convenience.

Table 4 is a 3-year summary of the 2001-2003 systems trial by seed technology group. This excludes BIIR and LL varieties because they were included in the test beginning in 2003. Bt (Bollgard) cottons are also excluded in the table because acreage has declined and they were in the test 2 years only.

For the 3 years, on average conventional varieties yielded less than BR varieties but resulted in the highest net returns due to higher price (fiber quality) and lower costs. Roundup Ready varieties averaged 100 lbs per acre less than stacked varieties and although cost was less, could not overcome the difference in yield. Conventional varieties averaged 1,030 lbs per acre, RR varieties averaged 969 lbs per acre, and “stacked” varieties (BR) averaged 1,069 lbs per acre.

For the 3 years of the study, total systems costs (seed including technology fee if applicable, herbicides, insecticides, and application) averaged \$101.22 per acre for conventional cotton, \$106.67 per acre for RR, and \$115.30 for BR.

The choice of variety within a system is perhaps as important as the choice of production system itself. There is still no substitute for yield. Within a technology, high yield and fiber quality are the parameters of choice. Also, costs benefits of a particular seed technology can be out weighed by differences in yield. A system with cost advantages can be less profitable than a higher-cost system if yield difference is great.

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TABLE 1A. Yield, Costs, and Net Return By Variety-- Systems Trial, Tifton- 2001

Variety	System	Lint Yield	Gin Turnout	Seed Yield	Price	Income Per Acre			System Costs					NET RETURN
						Lint	Seed	TOTAL	Seed	Herbicides	Insecticides	Application	TOTAL	
ST 4691B	B	1384	36.5	2124	60.78	841.20	79.65	920.85	41.00	27.77	10.43	37.09	116.29	804.56
FM989	C	1300	36.3	1953	61.53	799.89	73.24	873.13	10.80	27.77	10.43	37.09	86.09	787.04
ST 4892BR	BR	1351	36.3	2064	60.25	813.98	77.40	891.38	47.16	23.37	10.43	32.03	112.99	778.39
FM 966B	B	1324	37.4	1788	61.53	814.66	67.05	881.71	40.53	27.77	10.43	37.09	115.82	765.89
DP 555BR	BR	1316	39.7	1788	61.32	806.97	67.05	874.02	44.65	23.37	10.43	32.03	110.48	763.54
DP 458BR	BR	1277	35.7	2027	61.10	780.25	76.01	856.26	43.12	23.37	10.43	32.03	108.95	747.31
DP 33B	B	1277	34.5	2130	60.85	777.05	79.88	856.93	36.54	27.77	10.43	37.09	111.83	745.10
FM989BR	BR	1248	35.4	2020	61.28	764.77	75.75	840.52	45.60	23.37	10.43	32.03	111.43	729.09
DP 5415RR	R	1215	36.6	1895	60.85	739.33	71.06	810.39	16.55	23.37	10.43	32.03	82.38	728.01
ST580	C	1193	35.4	1911	60.85	725.94	71.66	797.60	9.35	27.77	10.43	37.09	84.64	712.96
PSC GA161	C	1175	34.5	1993	61.35	720.86	74.74	795.60	8.64	27.77	10.43	37.09	83.93	711.67
Delta Pearl	C	1170	37.3	1694	61.35	717.80	63.53	781.33	8.47	27.77	10.43	37.09	83.76	697.57
FM 989RR	R	1173	37.4	1738	60.85	713.77	65.18	778.95	20.00	23.37	10.43	32.03	85.83	693.12
DP 448B	B	1201	35.7	1917	60.85	730.81	71.89	802.70	36.63	27.77	10.43	37.09	111.92	690.78
SG 521RR	R	1112	35.6	1752	60.15	668.87	65.70	734.57	19.09	23.37	10.43	32.03	84.92	649.65
ST 4793RR	R	1131	37.2	1670	59.00	667.29	62.63	729.92	17.51	23.37	10.43	32.03	83.34	646.58

Highest yielding varieties not statistically different, probability 95%

TABLE 1B. Summary By Seed Technology Group, 2001

System	Lint Yield	Seed Yield	Price	Total Income	System Costs					Net Return
					Seed	Herbicides	Insecticides	Application	Total	
Conventional	1210	1888	61.27	811.92	9.32	27.77	10.43	37.09	84.61	727.31
B	1297	1990	61.00	865.55	38.68	27.77	10.43	37.09	113.97	751.58
R	1158	1764	60.21	763.46	18.29	23.37	10.43	32.03	84.12	679.34
BR	1298	1975	60.99	865.55	45.13	23.37	10.43	32.03	110.96	754.58

TABLE 2A. Yield, Costs, and Net Return By Variety-- Systems Trial, Tifton- 2002

Variety	System	Lint Yield	Gin Turnout	Seed Yield	Price	Income Per Acre			System Costs					NET RETURN
						Lint	Seed	TOTAL	Seed	Herbicides	Insecticides	Application	TOTAL	
FM989	C	914	39	1298	60.51	553.06	50.62	603.68	12.15	29.60	35.12	35.33	112.20	491.48
DP 555BR	BR	971	43	1165	56.09	544.63	45.44	590.07	54.94	24.05	10.43	25.71	115.13	474.94
PSC GA161	C	870	37	1312	60.51	526.44	51.17	577.61	11.20	29.60	35.12	35.33	111.25	466.36
Delta Pearl	C	863	40	1155	56.25	485.44	45.05	530.49	10.15	29.60	35.12	35.33	110.20	420.29
DP 458BR	BR	839	40	1112	56.25	471.94	43.37	515.31	46.79	24.05	10.43	25.71	106.98	408.33
DP 448B	B	793	38	1125	59.30	470.25	43.88	514.13	37.87	29.60	10.43	28.33	106.23	407.90
FM 991RR	R	788	37	1174	60.06	473.27	45.79	519.06	21.21	24.05	35.12	32.71	113.09	405.97
SG 215BR	BR	895	39	1213	51.29	459.05	47.31	506.36	52.61	24.05	10.43	25.71	112.80	393.56
ST 4892BR	BR	829	40	1096	54.75	453.88	42.74	496.62	49.28	24.05	10.43	25.71	109.47	387.15
FM989BR	BR	753	38	1049	59.30	446.53	40.91	487.44	51.02	24.05	10.43	25.71	111.21	376.23
DP 33B	B	777	38	1116	56.25	437.06	43.52	480.58	37.36	29.60	10.43	28.33	105.72	374.86
ST580	C	767	38	1088	56.25	431.44	42.43	473.87	11.70	29.60	35.12	35.33	111.75	362.12
FM 989RR	R	734	39	994	59.30	435.26	38.77	474.03	22.41	24.05	35.12	32.71	114.29	359.74
SG 521RR	R	748	38	1059	56.09	419.55	41.30	460.85	21.71	24.05	35.12	32.71	113.59	347.26
ST 4793RR	R	738	40	967	50.50	372.69	37.71	410.40	21.31	24.05	35.12	32.71	113.19	297.21

Highest yielding varieties not statistically different, probability 95%

TABLE 2B. Summary By Seed Technology Group, 2002

System	Lint Yield	Seed Yield	Price	Total Income	System Costs					Net Return
					Seed	Herbicides	Insecticides	Application	Total	
Conventional	854	1213	58.38	546.41	11.30	29.60	35.12	35.33	111.35	435.06
B	785	1121	57.78	497.36	37.62	29.60	10.43	28.33	105.98	391.38
R	752	1049	56.49	466.09	21.66	24.05	35.12	32.71	113.54	352.55
BR	857	1127	55.54	519.16	50.93	24.05	10.43	25.71	111.12	408.04

TABLE 3A. Yield, Costs, and Net Return By Variety-- Systems Trial, Tifton- 2003

Variety	System	Lint Yield	Gin Turnout	Seed Yield	Price	Income Per Acre			System Costs					NET RETURN
						Lint	Seed	TOTAL	Seed	Herbicides	Insecticides	Application	TOTAL	
DP 555BR	BR	1180	40	1562	70.73	834.61	74.20	908.81	63.18	29.22	8.60	24.71	125.71	783.10
FM 966LL	LL	1158	37	1763	70.60	817.55	83.74	901.29	26.72	29.46	31.70	31.75	119.63	781.66
DP 491	C	1104	38	1480	72.67	802.28	70.30	872.58	17.60	27.91	31.70	32.53	109.74	762.84
DP 494R	R	1110	37	1608	72.67	806.64	76.38	883.02	32.56	29.22	31.70	31.75	125.23	757.79
ST 5599BR	BR	1146	37	1646	69.87	800.71	78.19	878.90	62.46	29.22	8.60	24.71	124.99	753.91
FM 989 BR	BR	1114	36	1754	70.58	786.26	83.32	869.58	63.84	29.22	8.60	24.71	126.37	743.21
Delta Pearl	C	1054	38	1520	72.65	765.73	72.20	837.93	17.42	27.91	31.70	32.53	109.56	728.37
SG 521R	R	1063	36	1689	65.78	699.24	80.23	779.47	27.20	29.22	31.70	31.75	119.87	659.60
SG 215BR	BR	1058	35	1714	65.24	690.24	81.42	771.65	59.22	29.22	8.60	24.71	121.75	649.90
PSC GA 161	C	922	34	1587	72.50	668.45	75.38	743.83	11.70	27.91	31.70	32.53	103.84	639.99
DP 424BIIR	BIIR	990	33	1742	68.65	679.64	82.75	762.38	68.82	29.22	8.60	24.71	131.35	631.03
ST 4646 BIIR	BIIR	975	35	1609	66.99	653.15	76.43	729.58	68.95	29.22	8.60	24.71	131.48	598.10
FM 991R	R	881	34	1471	70.58	621.81	69.87	691.68	29.52	29.22	31.70	31.75	122.19	569.49
ST 4793R	R	929	37	1429	66.81	620.66	67.88	688.54	29.41	29.22	31.70	31.75	122.08	566.46
DP 458BR	BR	767	36	1197	70.58	541.35	56.86	598.21	57.73	29.22	8.6	24.71	120.26	477.95

Highest yielding varieties not statistically different, probability 95%

TABLE 3B. Summary By Seed Technology Group, 2003

System	Lint Yield	Seed Yield	Price	Total Income	System Costs					Net Return
					Seed	Herbicides	Insecticides	Application	Total	
Conventional	1027	1529	72.61	818.11	15.57	27.91	31.70	32.53	107.71	710.40
RR	996	1549	68.96	760.68	29.67	29.22	31.70	31.75	122.34	638.34
BR	1053	1575	69.40	805.43	61.29	29.22	8.60	24.71	123.82	681.61
BIIR	983	1676	67.82	745.98	68.89	29.22	8.60	24.71	131.42	614.57
LL	1158	1763	70.60	901.29	26.72	29.46	31.70	31.75	119.63	781.66

TABLE 4. 3-Year Average Summary By Seed Technology Group

System	Lint Yield	Seed Yield	Lint Price	Total Income	System Costs					Net Return
					Seed	Herbicides	Insecticides	Application	Total	
Conventional	1030	1543	64.09	725.48	12.06	28.43	25.75	34.98	101.22	624.26
Roundup Ready	969	1454	61.89	663.41	23.21	25.55	25.75	32.16	106.67	556.74
Stacked *	1069	1559	61.97	730.04	52.45	25.55	9.82	27.48	115.30	614.75

* excludes BIIR