2003 COLQUITT COUNTY SYSTEMS TRIAL
YIELD, QUALITY, COSTS, AND NET RETURNS

Scott N. Brown[1] and W. Don Shurley[2]

[1] University of Georgia, Cooperative Extension Service, Colquitt County, GA
[2] Dept. of Agricultural and Applied Economics, University of Georgia, Tifton

Introduction

Transgenic (biotechnology) cotton accounts for over 90 percent of planted acres in Georgia. Compared to conventional (non-transgenic) varieties, transgenic type (Bt, RR, BR) varieties offer herbicide (glyphosate) resistance (RR), insect resistance (Bt), or both (BR). A December 2002 survey of Colquitt County cotton producers indicated that producers were planting a mixture of technology types. Conventional varieties represented 21% of the 63,500 acres planted in the county while "stacked gene" (BR) technology was 44% and Roundup Ready (RR) and Bt technology were 17% and 18% of the acreage respectfully. Acreage of BR has increased while acreage of Bt and RR has decreased.

The most common question asked by producers participating in the 2002 survey was, "Does it pay to spend the extra money on RR and Bt technology or would I be better off to plant conventional lines". Net returns and difference in net return among various technologies depends on yield and quality, incidence and severity of pest problems, costs of weed and insect control, and variety selection within the respective system.

To help answer this question, a cotton variety "systems trial" was conducted in Colquitt County, GA during 2003. In a systems trial, each seed technology is produced within it's respective weed and insect management system. For each technology, yield, lint quality, costs, and net returns are calculated to compare both agronomic and economic differences.

Materials and Methods

Six cotton varieties- 3 conventional (DP 493, DP 491, and FM 966), 1 glyphosate resistant (DP 494R), and 2 "stacked" (DP 555BR and FM 960BR) were planted April 17, 2003 on the farm of cooperator Ronald Baker in a pivot irrigated field on Tifton loamy sand soil. The test was a randomized block design. Each variety was replicated 4 times. Each replication was 8-38" rows in width and the length of the field. Each replication was approximately .51 acres and total acres of each variety was approximately 2.05 acres.

The varieties selected for the trial were chosen based on (1) grower interest/intent on planting in 2003, (2) ability to produce good yield and quality, and (3) grower use or plans to use the technology type. Single gene Bt varieties were not included in the test because

they are being discontinued by most seed companies. Only one RR variety was selected due to reduced interest by growers and possible lower yield and quality associated with these varieties. Due to the size of each plot, the number of replications to be used, and the necessity of having 8 border rows on either side of the RR and BR varieties to prevent drift of glyphosate to the conventional varieties, only six varieties were selected for the test.

All varieties were planted at a rate of 2.4 seed per foot of row (hill dropped, 2 seed every 10"). All systems received the same fertilizer, lime, tillage, and defoliation. Each system, however, received herbicide and insecticide inputs according to it's respective technology and in accordance with University of Georgia recommended practices for the pests and situations present. The herbicide and insecticide inputs by system are outlined in Table 1. The use/need of mepiquat chloride (MC) plant growth regulator, however, varied by variety rather than system.

Prowl was used PPI on all varieties, including the RR, due to the severity of Florida pusley and pigweed. The post-emergence directed treatment of Cotoran + Staple+ MSMA was used on all varieties, including RR and BR, due to a flush of pitted morningglory and the presence of purple moonflower and wild poinsettia that had emerged after the 4 leaf stage OTT glyphosate treatment. Two treatments of glyphosate were planned for the RR and BR varieties but the initial treatment was prevented by windy conditions that could have resulted in drift to the conventional plots.

All systems received Temik in-furrow and at sidedress (6 leaf stage) for thrips and southern root-knot nematode control. The trial was scouted for insects every five days. Non-Bt (conventional and RR) and BR cotton were scouted separately and treated independently as needed. All plots were sprayed for aphids. The BR cotton was sprayed 4 times for stink bugs and escaped corn earworm. The non-Bt cotton was sprayed 6 times for worms and stink bugs. Both bollworm and stink bug pressure was intense. The non-Bt had to be treated 2 times with Tracer due to pyrethroid tolerance problems with tobacco budworm. Since Tracer has no activity on stink bugs, additional sprays specifically targeted for this pest had to be made in the non-Bt cotton.

All varieties and systems were defoliated and harvested the same. The crop was defoliated with a three-way mix of Prep, Dropp, and Folex on September 19 and harvested with a 4-row spindle picker. Each replication for each variety was harvested separately and the seedcotton from each rep weighed separately with a boll buggy equipped with a scale. All reps of the same variety were placed in a trailer designated for that variety thus producing approximately 2 acres of seedcotton per variety for ginning. Ginning turn-out and total lint weight were determined from ginning these combined reps of each variety. The gin turn-out reported was then applied to the seedcotton yield of each rep to determine the actual lint yield for each rep. The yield reported for each variety is the average of all reps for that variety.

Quality parameters for Color, Leaf, Staple, Strength, Micronaire, and Uniformity were reported for each bale of each variety. The price per pound of lint for each bale was the November 2003 average Georgia price of 69.6 cents per pound for Color 41-Leaf 4/ Staple 34 cotton adjusted for the quality parameters of each bale (USDA-AMS). The Net Return (NR) for each variety within each system was calculated as:

$$NR = Y \times (P + Q) - C$$

Y is the average yield of all 4 reps, P is 69.6 cents per pound, Q is the per pound weighted average premiums and discounts from all bales of that variety, and C is the "systems costs" (Table 3). Costs other than seed, herbicides, insecticides/nematicides, and plant growth regulator (because they were the same regardless of system) need not and were not considered. Cottonseed income was not considered because there was no reliable way to determine cottonseed weight by variety from seedcotton weight and gin turn-out.

Prices for seed, herbicides, insecticides, nematicides, and PGR were available from company representatives or local suppliers. Application costs included fuel, labor, repairs, depreciation, interest, and insurance for machinery and implements and derived from University of Georgia estimates (Smith, et.al.). Application was not charged if an input was "piggy-backed" with another.

Results and Discussion

Yield

The highest yielding variety was DP 555BR at 1,552 pounds per acre followed by DP 493 at 1,462 pounds per acre (Table 2). The lowest yielding variety was FM 966 at 1,179 pounds per acre. Among the 2 BR system varieties, DP 555BR yielded 248 pounds per acre higher than FM 960BR. The single RR variety, DP 494R, yielded 1,226 pounds per acre. Conventional cottons averaged 1,299 pounds per acre and BR cottons averaged 1,427 pounds per acre.

There was a wide difference in ginning turn-out (pounds of lint per pound of seedcotton expressed as a percentage) among varieties. This is thought to be largely a function of seed size. FM 966 (a large seed variety) had a turn-out of 36.1% compared to DP 555BR (a small seed variety) with a gin turn-out of 41.2%

Quality

DP 555BR expressed somewhat better Color and Leaf Grade than other varieties in the trial but was slightly less in Staple, Strength, and Uniformity (Table 2). Overall, the highest quality varieties were DP 491 and DP 494R. Quality parameters were available for each bale of each variety. Table 1 shows the distribution of Color-Leaf grade among the bales and the weighted average Staple, Strength, Micronaire, and Uniformity. Conventional varieties (DP 493 and 491 and FM 966) on average had better Staple and Strength than the BR varieties (DP 555BR and FM 960BR). RR cotton (DP 494R) had better Staple, Strength, and Uniformity than any other variety. RR cotton's in previous study and

experience have not always expressed the best yield and quality (Shurley, et.al.) but DP 494R performed favorably in terms of lint quality.

Costs

System and variety costs are summarized in Table 3. Seed cost for conventional varieties averaged $9.61 per acre compared to $17.52 per acre for RR and $39.90 per acre for BR including technology fees.

Combined seed cost and technology fee for RR was $7.91 per acre higher than the average for conventional varieties. In addition, due to the spectrum and severity of weeds, herbicide costs (including application cost) were $7.88 per acre higher for RR compared to conventional. Compared to conventional varieties, RR was $15.79 ($7.91 + $7.88) per acre higher in weed control costs.

The combined seed and technology cost for BR varieties averaged $30.29 per acre higher than the average for conventional varieties. Herbicide and insecticide costs for BR (including application) were $22.24 per acre lower than conventional– a net savings of $8.05 per acre.

There were no Bt only varieties in the trial. However, assuming and applying the $7.91 additional cost for RR in DP 494R to the additional average combined BR cost of $30.29, would result in an "implied" Bt only cost of $22.38 per acre in the BR cottons. Insecticide costs including application for BR cottons were $30.12 per acre lower than non-Bt cottons (conventional and RR)– a net savings of $7.74 per acre on the Bt portion of the technology. Thus on the BR technology, the RR portion did not profit but the Bt portion did.

Net Returns

DP 555BR resulted in the highest Net Return at $866.99 per acre followed by DP 493 at $822.80 (Table 3). DP 555BR did not produce the highest quality among the varieties in the test but was the highest yielding variety. Among the conventional varieties, DP 493 was the highest yielding and highest in Net Return. Lowest Net Return was for FM 966. DP 491 and DP 494R received the highest price due to higher quality parameters but did not rank higher in Net Return due to yield

Total system/variety costs ranged from a low of $195.00 per acre for FM 966 to $220.97 for DP 494R and $220.73 per acre for DP 555BR. Costs varied by only $25.97 per acre regardless of system and variety. By comparison, gross income (yield times price) varied by $261.24 per acre. Yield, therefore, was a larger factor in Net Return than type of technology.

Table 4 provides a summary of yield, costs, and Net Return by technology or system. BR varieties averaged 1,427 pounds per acre compared to 1,299 for conventional and 1,226 for RR. System/variety costs averaged $201.97 per acre for conventional, $220.97 per acre for RR and $211.48 for BR. Net Return was highest for BR at $790.54 per acre. This was due primarily to the yield per acre of DP 555BR.

Summary

Net returns and difference in net return among various cotton seed technologies depends on yield and quality, incidence and severity of pest problems, costs of weed and insect control, and variety selection within the respective system. In this test, conventional herbicide chemistry was used even on RR and BR cotton's due to the weeds and conditions present. Worm and stink bug pressure was intense resulting in multiple spray applications even on BR cottons.

Yield was a major factor in addition to technology or system. DP 555BR was the highest-yielding variety. Conventional varieties were the lowest cost but only DP 493 ranked high in yield.

Comparing Net Returns by technology, BR resulted in the highest Net Return. RR gave the lowest Net Return. This was a function of lower yields and high cost due to the weed situation.

References

Shurley, W. Don, O. Lloyd May, A. Stanley Culpepper, and Phillip M. Roberts. "Economic Net Returns Comparing Conventional and Transgenic Cotton Varieties, 2001-2002", *2002 Cotton Research-Extension Report*, University of Georgia, 2003.

Smith, Nathan, Don Shurley, William Givan, and Curt Lacy. *South Georgia Crop Enterprise Cost Analysis*, AGECON-94-010-S-Revised, Department of Agricultural and Applied Economics, University of Georgia, February 2003.

USDA- Agricultural Marketing Service. *Cotton Price Statistics*, Vol. 85, No. 4, November 2003, Memphis, TN.

ACKNOWLEDGMENTS

The authors express appreciation to Mr. Ronald Baker as cooperator/producer; to Delta Pine and FiberMax seed companies for seed and financial support for custom harvesting; to Bayer, Dow AgroSciences, and Monsanto chemical companies for suppling defoliants and pesticides used. The authors would also like to thank Mr. Doyle Carlton, Mr. Billy Gene Middlebrooks, and Mr. Cliff Middlebrooks of Norman Park Gin for their time and effort to segregate and accurately gin the plot samples. A special thanks to Mr. Ty Fowler of Delta Pine for assistance in harvesting logistics.

Table 1. System and Variety Inputs Applied, 2003 Colquitt County Systems Trial

System	Conventional			RR	BR	
Variety	DP 491	DP 493	FM 966	DP 494R	FM 960BR	DP 555BR
Herbicides	Prowl (1 qt/ac PPI)					
	Cotoran (12 oz/ac) + Staple (.3 oz/ac) (14" banded AP)					
	Cotoran (1pt/ac) + MSMA (1 pt/ac) + Staple (.44 oz/ac) (14" banded Post-Direct)					
				Glyphosate (1 qt/ac OTT)		
	Cultivate					
Insecticides/ Nematicides	Temik (5 lbs/ac In-furrow AP)					
	Temik (5 lbs/ac Side-dress)					
	Trimax (1.25 oz/ac)					
	Baythroid (2.13 oz/ac/application, 2x)					
	Tracer (2 oz/ac/application, 2x)					
	Bidrin (12.8 oz/ac/application, 2x)					
MC	42 oz (5x)	42 oz (5x)	24 oz (4x)	42 oz (5x)	24 oz (4x)	60 oz (5x)

Table 2. Yield and Quality By Variety, 2003 Colquitt County Systems Trial

			Color-Leaf Grade (% Bales)							
Variety	Yield [1]	Gin T/O %	31-3	41-3	41-4	41-5	Avg Staple	Avg Strength	Avg Mic	Avg Uniformity
DP 555BR	1552 a	41.2	14	29	57		34.9	28.0	4.37	79.6
DP 493	1464 b	39.0		17	83		35.0	27.9	4.42	80.0
FM 960BR	1304 c	37.1		17	83		34.7	29.7	4.15	81.3
DP 491	1255 cd	36.3			100		36.6	30.7	4.26	80.8
DP 494R	1226 de	36.6			100		36.8	30.8	4.44	82.0
FM 966	1179 e	36.1			80	20	36.0	30.2	4.22	80.8

1/ Yields followed by a different letter are statistically higher or lower than others at > 90% confidence. Yields followed by the same letter are not statistically different.

Table 3. System Per Acre Costs and Net Returns, 2003 Colquitt County Systems Trial

			System/Variety Costs Per Acre						
Variety	Yield	Price	Seed	Herb	Insecticide/ Nematicide [1]	PGR	Appl [2]	Total	Net Return
DP 555BR	1551	.7013	41.28	30.19	61.81	20.40	67.05	$220.73	$866.99
DP 493	1464	.7027	10.38	25.81	84.93	14.28	70.55	$205.95	$822.80
FM 960BR	1304	.7027	38.52	30.19	61.81	8.16	63.55	$202.23	$714.09
DP 491	1255	.7085	9.40	25.81	84.93	14.28	70.55	$204.97	$684.20
DP 494R	1226	.7075	17.52	30.19	84.93	14.28	74.05	$220.97	$646.43
FM 966	1179	.7010	9.05	25.81	84.93	8.16	67.05	$195.00	$631.48

1/ Includes $30.80 per acre nematicide cost for all varieties/systems. Actual insecticide only cost was $31.01 per acre for BR varieties and $54.13 for non-Bt varieties.
2/ Includes 1 cultivation ($5.39) and 1nematicide sidedress application ($3.71) for all systems. Herbicide application is $22.95 for all systems plus $3.50 additional spray for RR and BR. Insecticide application is $14.00 for all systems plus $7.00 for 2 additional sprays for non-Bt. Mepiquat chloride PGR application is $14.50 for FM 960BR and FM 966 and $17.50 for DP 491, DP 493, DP 494R, and DP555BR. Herbicide and application costs only (including cultivation) was $54.15 for conventional and $62.03 for BR and RR. Insecticide and application costs only was $45.01 for BR and $75.13 for non-Bt (conventional and RR).

Table 4. Summary of Net Returns By System, 2003 Colquitt County Systems Trial

System	Varieties	Average Yield	Costs	Net Return
Conventional	DP 493, DP 491, FM 966	1299	$201.97	$712.83
RR	DP 494R	1226	$220.97	$646.43
BR	DP 555BR, FM 960BR	1427	$211.48	$790.54