GEORGIA COTTON ECONOMICS IN THE POST-555 ERA

W. Don Shurley
Guy D. Collins
Stanley Culpepper
Phillip M. Roberts
Amanda R. Smith
University of Georgia
Tifton, GA
Jared R. Whitaker
University of Georgia
Statesboro, GA

Abstract

The EPA registration for single-gene Bollgard® technology expired with the 2009 crop. One single-gene Bollgard variety, DeltaPine DP555BR, accounted for approximately 85 percent of all Georgia cotton acres planted. The net loss in farm and gin income in Georgia due to the loss of DP555BR and other single-gene varieties was estimated at $36.55 million annually. The elimination of single-gene (B1) technology after the 2009 crop year resulted initially in a shift to mostly Bollgard II (B2) varieties. Widestrike (W) varieties gained share in 2012 with the introduction of PHY499WRF. In 2010 and 2011, there was an increase in share for Liberty-Link (LL and LLB2) varieties but share declined in 2012. New Glytol/Liberty Link® (GL) technology grabbed 1 percent of acreage in 2012 and may increase further in 2013. Yield of the top-yielding newer varieties has generally been comparable to 555 especially under irrigation. Fiber quality has also improved significantly. B2 and W technology comes bundled with Roundup-Ready Flex technology (B2RF and WRF) or Liberty-Link (B2LL) or Glytol/Liberty-Link (GLB2). Thus, the loss of single-gene (B1) technology also meant that growers would have to move to RF, LL, or GL technology for weed control. B2RF, WRF, and LLB2 varieties were available to growers prior to the expiration of single-gene varieties but Georgia growers did not plant those varieties as long as DP555BR was available. After the loss of 555, Georgia growers switched largely to new Deltapine (DP) varieties and Phytogen (PHY) varieties but the proportion of acreage planted to PHY increased significantly and DP decreased in 2012 due to increased planting of PHY499WRF—a high yielding variety. Yield continues to be the number one factor in variety selection-- perhaps signaling that growers feel they can make any technology fit and that technology is secondary to yield potential. Combined technology-related costs (seed, technology fees, herbicides, and insecticides excluding tillage and application) are estimated to be $155 to $177 per acre for 2013 compared to $116 per acre for DP555BR in 2009.

Introduction

The EPA registration for single-gene Bollgard® technology (further referred to as B1 here) expired with the 2009 crop. Suppliers limited remaining seed inventory was allowed carried forward to 2010 and planted but, beginning with the 2011crop, producers had to plant two-gene varieties (Bollgard II® or Widestrike® technologies) or non-transgenic varieties.

Prior to 2010, one single-gene Bollgard variety, DeltaPine DP555BR, accounted for approximately 85 percent of all Georgia cotton acres planted. In University of Georgia Official Variety Trials (OVT's), large on-farm trials, and in farmer's own experience, DP555BR had proven superior yield compared to other varieties and technologies then available.

The net loss in farm and gin income in Georgia due to the loss of DP555BR and other single-gene varieties was estimated at $36.55 million annually (Shurley and Roberts). Income loss was due largely to the difference in yield between DP555BR and other variety choices available to producers at the time (2004 through 2007). Producers were concerned about losing DP555BR because there was no replacement available with equivalent yield potential.

Objectives and Methodology

The objective of this research is to begin to determine the actual impact of the loss of DP555BR on profitability. Specifically, the objective is to explore changes in yield and fiber quality since 2009. The three years since the loss of single-gene (B1) technology (2010-2012) are compared to the three years prior to the loss (2007-2009). This research will also determine changes in costs of production since 2009 due directly to changes in producers' technology choices.

Results

Varieties and Technology

From 2007 to 2009, DP555BR averaged 84% of Georgia's acres planted. No other single variety during this time had even 3% of acreage (Table 1). In anticipation of losing single-gene cotton varieties and 555 in particular, UGA Extension encouraged growers to begin planting other varieties and technology in small amounts to gain knowledge and experience on their farm. In 2009, the last year single-gene technology was fully available, producers reduced 555 acreage only slightly and planted increased the percentage of Phytogen PHY370WR and new varieties DP0935B2RF and DP0949B2RF.

Table 1. Percent of Cotton Acres Planted By Variety, Georgia, 2007-2012.

2007		2008		2009		2010		2011		2012	
Variety	**Pct**	**Variety**	**Pct**	**Variety**	**Pct**	**Variety**	**Pct**	**Variety**	**Pct**	**Variety**	**Pct**
DP555BR	83.59	DP555BR	85.85	DP555BR	82.53	DP555BR	24.74	DP1050B2RF	25.03	PHY499WRF	32.39
DP515BR	2.86	DP515BR	1.48	PHY370WR	2.74	DP0949B2RF	12.52	DP1048B2RF	16.38	DP1050B2RF	21.58
PHY480WR	1.66	PHY480WR	1.37	DP0935B2RF	2.61	PHY375WRF	8.40	PHY375WRF	12.98	DP1048B2RF	13.16
DP454BR	1.16	DP444BR	1.25	DP0949B2RF	2.14	PHY370WR	8.36	PHY565WRF	10.76	PHY375WRF	5.73
DP444BR	1.11	PHY370WR	1.18	ST5458B2F	1.07	FM1740B2F	7.01	FM1845LLB2	6.21	FM1845LLB2	4.63
DP445BR	.79	DP434RR	1.02	PHY480WR	.85	DP0935B2RF	5.63	DP0912B2RF	6.05	DP1252B2RF	4.07
DP488BR	.60	DP454BR	.77	FM1740B2F	.84	FM1845LLB2	4.77	DP1034B2RF	3.71	DP0912B2RF	2.97
PHY470WR	.57	DP432RR	.55	PHY485WRF	.68	DP1048B2RF	4.76	FM1740B2F	3.54	DP1137B2RF	2.42
FM960BR	.49	DP147RF	.46	PHY375WRF	.59	DP1050B2RF	4.62	DP1137B2RF	3.29	PHY565WRF	2.06
DP434RR	.49	FM960BR	.45	FM1845LLB2	.47	PHY480WR	2.75	DP0949B2RF	2.73	ST5458B2RF	1.83
All Others	6.68	All Others	5.62	All Others	5.48	All Others	16.44	All Others	9.32	All Others	9.16

SOURCE: USDA-AMS

With the limited availability of DP555BR in 2010, producers shifted acreage to two-gene (B2) DP 09 and 10 varieties and Widestrike (W) PHY varieties. There was also increased planting of FiberMax FM varieties 1740B2F and 1845LLB2. Some varieties with increased acreage share in 2010 had a smaller share in previous years but increased with the demise of 555.

Beginning in 2011, the landscape has shifted mostly to newer available Deltapine (DP) varieties and Phytogen (PHY) varieties. Liberty-Link® (LL) varieties have also increased somewhat in acreage share but account for only about 5% of acres.

PHY499WRF was planted on almost one-third of Georgia acreage in 2012 followed by two DP varieties. PHY499WRF has been a top yielder in recent UGA Official Variety Trials (OVT's). With the loss of 555, Georgia cotton producers are now planting a wider/larger number of varieties. No single variety now dominates but the top three now did account for almost 70 percent of acreage in 2012.

Technology planted is a function of many factors including yield potential of available varieties, cost, weed and insect control required, desired pest management regime, and availability of seed supply. Table 2 shows cotton seed technology planted in Georgia for the period 2007 through 2012.

The elimination of single-gene (B1) technology after the 2009 crop year resulted initially in a shift to mostly Bollgard II (B2) varieties. Widestrike (W) varieties gained share in 2012 with the introduction of PHY499WRF. In 2010 and 2011, there was an increase in share for Liberty-Link (LL and LLB2) varieties but share declined in 2012. New Glytol/Liberty Link® (GL) technology grabbed 1 percent of acreage in 2012 and may increase further in 2013.

Two-gene varieties (B2 and W), come bundled with Roundup Ready Flex® (RF) technology compared to single-gene varieties like DP555BR that were bundled with regular Roundup Ready®. So effectively, the elimination of single-gene technology also required producers to purchase RF technology rather than R. Georgia producers have yet to embrace LL compared to other technologies although acreage share has increased since the loss of 555.

Other technologies (alternatives to BR) have been available to producers even when DP555BR was dominating Georgia acreage. Producers did not shift to these technologies until 555 was no longer available and because of the technology bundles available.

Table 2. Percent of Cotton Acres Planted By Seed Technology, Georgia, 2007-2012.

Seed Technology	2007	2008	2009	2010	2011	2012
RR	2.36	2.34	.63	0.00	0.00	0.00
RF	.21	.68	.96	.90	.35	0.00
BR	92.29	90.33	83.03	25.6	.37	N/A
B2R	0.00	.38	.32	0.00	0.00	0.00
B2RF	.15	.90	7.93	40.70	65.20	50.66
LL	.07	0.00	0.00	0.00	.02	0.00
LLB2	.10	.12	.77	8.10	8.37	5.01
GLB2	N/A	N/A	N/A	N/A	N/A	1.02
W	0.00	0.00	.38	.90	.54	1.06
WR	2.30	2.55	3.59	11.20	.33	0.00
WRF	0.00	0.40	1.27	11.90	24.33	40.26
Non-Transgenic	.62	.62	.10	.00	.00	.20
Not Otherwise Specified	1.90	1.68	1.02	.70	.48	1.79

SOURCE: USDA-AMS

Fiber Quality

During the "555 era", Georgia cotton was often criticized by mills for poor fiber quality. Although many factors impact fiber quality and no relationship was ever established, 555 nonetheless became the target of criticism since it was the dominate variety planted. Specifically, quality concerns were fiber length Uniformity and Staple.

In recent years, the quality of Georgia cotton has improved significantly (Table 3). Staple and Uniformity have both improved. The percentage of the crop with less than 34 Staple has declined to less than 5 percent and the average Staple length has been roughly 36 for the last two years. The percentage of the crop with less than 80 Uniformity has also greatly declined. Average Uniformity has been 81 or higher each of the last three years.

Table 3. Selected Fiber Quality Characteristics, Georgia, 2007-2012

	2007	2008	2009	2010	2011	2012
Average Staple	34.4	34.5	34.9	34.9	35.9	36.0
% Bales Staple 33 and shorter	20.9	16.5	4.9	16.3	3.7	1.4
Average Uniformity	80.1	80.2	80.2	81.0	81.7	81.6
% of Bales Uniformity Less Than 80	29.8	25.7	26.8	14.9	3.1	3.8

SOURCE: USDA-AMS

Yield of DP555BR Compared to Other Varieties

Figures 1 and 2 compare DP555BR to other varieties and technologies in the last three years (2007 through 2009) that single-gene technology was fully available. DP555BR is compared to the top-yielding non-B1 variety each year and to non-B1 varieties that were in the tests all 3 years. Figure 1 is non-irrigated production in UGA OVT's at three locations– Tifton, Plains, and Midville. Figure 2 is irrigated production at four locations– Bainbridge, Tifton, Plains, and Midville.

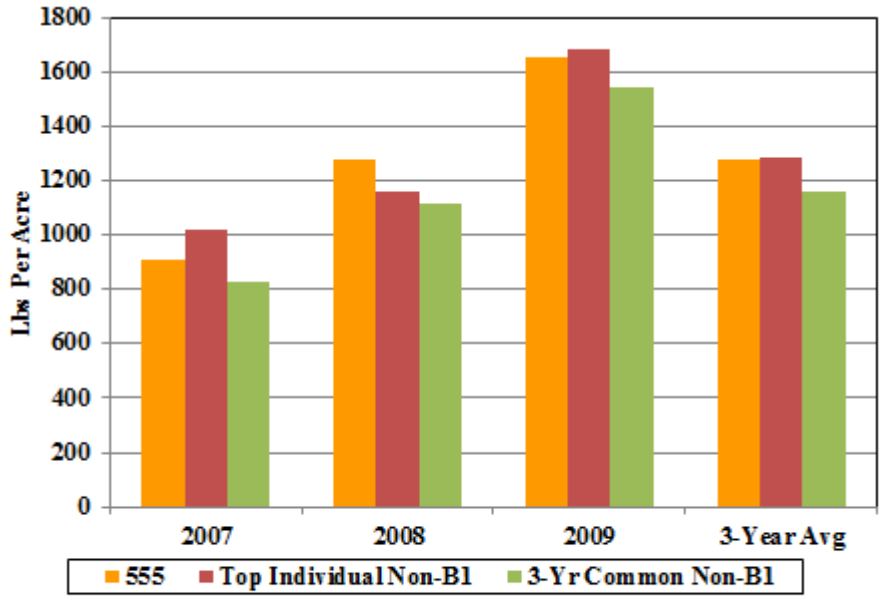

Figure 1. UGA OVT Yields, Non-Irrigated 3 Locations (Tifton, Plains, and Midville).

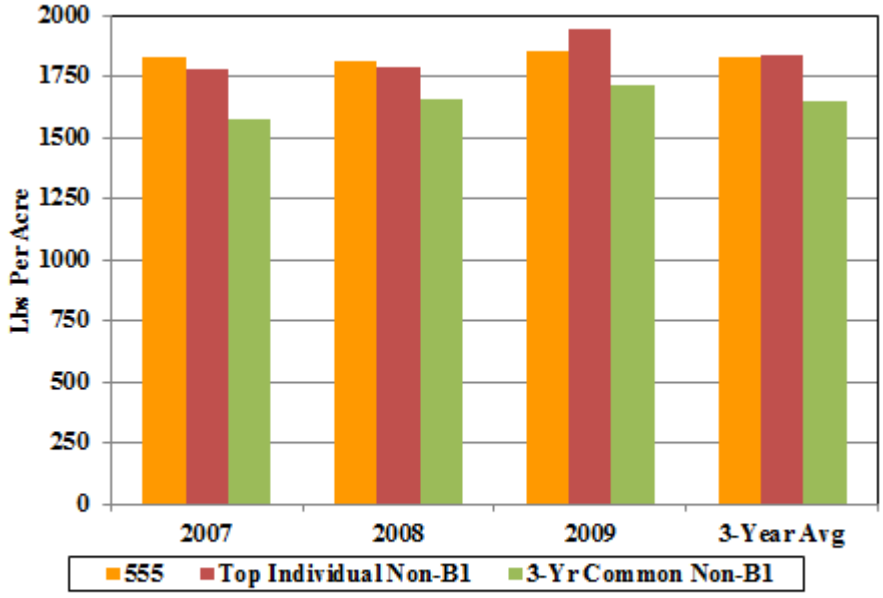

Figure 2. UGA OVT Yields, Irrigated 4 Locations (Bainbridge, Tifton, Plains, and Midville).

In non-irrigated production (Figure 1), in 2 of the 3 years, a non-B1 variety out-yielded 555. Averaged across all three years, the top non-B1 variety each year averaged 1,286 pounds per acre compared to 1,278 pounds per acre for 555. Of the non-B1 varieties that were included in the tests all three years, they averaged 1,160 pounds per acre compared to 1,278 pounds for 555.

In irrigated production (Figure 2), DP555BR out-yielded the top non single-gene (Non-B1) variety in two of the three years. For the three years, 555 averaged 1,830 pounds per acre. The top non-B1 variety each year averaged 1,835 pounds per acre. The non-B1 varieties common to the tests all three years averaged 1,645 pounds per acre–almost 200 pounds per acre less.

UGA Extension recommends that producers choose varieties on the basis of not only yield, but also yield stability. Stability is a characteristic of how a variety performs over both time and location– under multiple environments. For the period 2007 through 2009, the data shows that a variety may outperform 555 in a given year but no single variety out-yielded 555 over all three years.

Yield of Newer Varieties Compared to DP555BR

Figures 3 and 4 compare the yield of newer varieties and technologies to the yield of DP555BR. The yield of varieties for 2009 through 2012 (the 3 years since the elimination of single-gene technology) is compared to the performance of 555 for the period 2007 through 2009 (the last 3 years prior to elimination). These yield data are from UGA Official Variety Trials (OVT's).

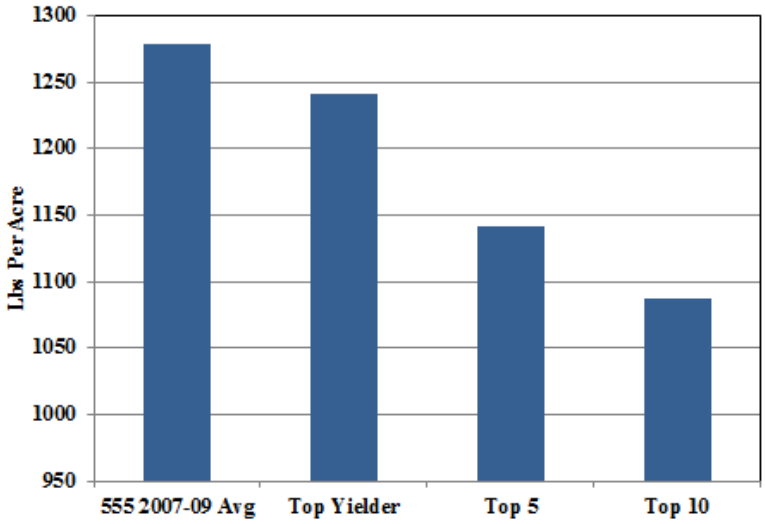

Figure 3. UGA OVT Yields, Newer Varieties 2010-12 Compared to DP555BR, Non-Irrigated at 3 Locations (Tifton, Plains, and Midville).

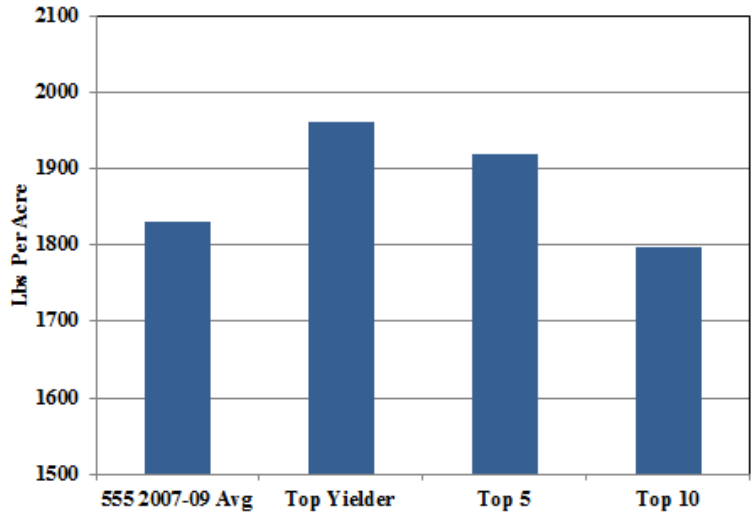

Figure 4. UGA OVT Yields, Newer Varieties 2010-12 Compared to DP555BR, Irrigated at 4 Locations (Bainbridge, Tifton, Plains, and Midville).

Non-irrigated yield is from three locations– Tifton, Plains, and Midville. For 2007-2009, DP555BR averaged 1,278 pounds per acre (Figure 3). The highest yielding variety each year for 2010-2012 averaged only slightly less at 1,241 pounds per acre. Yield is also shown for the highest five yielding varieties and the highest ten. In non-irrigated production, the yield of newer varieties has not equaled the performance of 555 although weather is always a factor.

In irrigated production (Figure 4), newer varieties have performed very well. Yield is from four locations– Bainbridge, Tifton, Plains, and Midville. For 2007-2009, DP555BR averaged 1,830 pounds per acre. By comparison, the top-yielder each year for 2010-2012, averaged 1,962 pounds per acre. The five highest yielding varieties averaged 1,920 pounds per acre.

Technology-Related Costs

The choice of technology is a selection of pest management regime. Since the loss of single-gene Bollgard technology, two-gene varieties are Bollgard II with Roundup-Ready Flex (B2RF or B2F), Widestrike with Roundup-Ready (WR) or Roundup-Ready Flex (WRF), or Bollgard II with Liberty-Link (LLB2) or Glytol/Liberty-Link (GLB2). While the loss of single-gene Bollgard technology and DP555BR specifically was of concern to growers from a yield perspective, newer technologies do offer considerable value to the grower.

Compared to single-gene technology, B2 and W offer better control in severe caterpillar pressure. B2 and W provide better control of corn earworm. Two-gene technology also provides broader spectrum control with improved control on armyworms and soybean looper. W provides better control of fall armyworm. B2 provides better control of corn earworm.

Most single-gene technology came bundled with Roundup-Ready technology (BR). Two-gene technologies, however, come bundled with RF or LL or GL for weed control. RF technology allows a later, post-emergence application which generally occurs between the 5 and 8-leaf stage. This would be problematic in R cotton. GL has added flexibility over RF or LL in that the grower can apply both Liberty and glyphosate as needed. Compared to GL, Widestrike (W) varieties can have injury from Liberty applications.

Technology-related costs include seed, technology fees, weed control, and insect control (Table 4). In 2009, the cost for DP555BR was $65.41 per acre (seed plus technology fee). Compared to 2009 (the last year single-gene Bollgard was available), growers are paying more due to the shift from B1 to B2 or W and from R to RF since B2 and W technologies are largely available only with RF or LL. For 2013, combined seed and technology fee cost is estimated at $84.24 per acre for B2RF, $82.42 for WRF, and $86.15 for GLB2. These costs in 2013 are approximately $19 per acre higher than DP555BR in 2009. This difference is due to change in technology and increase in seed and technology fees.

Table 4. Estimated Variety and Technology Related Costs[1] Per Acre in 2013 Compared to DP555BR.

	2009 DP555BR[3]	**2013 B2RF**	**2013 WRF**	**2013 GLB2**
Seed[2]	$20.03	$24.39	$25.73	$55.69
Technology Fees	$45.38	$59.85	$56.69	$30.46
Herbicides (conventional tillage)[4]	$33.15	$63.18	$63.18	$82.00
Insecticides (spray applications only)	$17.30	$9.10	$9.10	$9.10
Total Cost Per Acre	**$115.86**	**$156.52**	**$154.70**	**$177.25**

1/ Excludes tillage and application costs.
2/ Calculated based on 36-inch row spacing, 2.5 seed per foot of row. GLB2 seed cost includes GL tech fee.
3/ Based on UGA enterprise budget estimates for 2009 (Shurley and Smith).
4/ Assumes starting clean with tillage, no PPI (Culpepper, et. al.).

Herbicide costs for 2013 are based on UGA Extension recommendations for controlling glyphosate resistant Palmer Amaranth (Culpepper, et.al.). For Roundup-Ready Flex (RF) cotton, cost per acre is estimated at $63.18 per acre compared to only $33.15 per acre in 2009. Cost has increased due to the increased use of residual herbicides to battle glyphosate resistance even with more expensive RF technology.

Herbicide cost for Glytol/Liberty-Link (GL) technology is estimated at $82 per acre compared to $63.18 for RF. Higher cost is due to more expensive Liberty herbicide compared to glyphosate and not being eligible for Monsanto rebates available with RF varieties.

Insecticide cost is estimated at $9.10 per acre for 2013 for B2 and W cotton compared to $17.30 per acre in 2009 with single-gene (B1) technology. In 2009, budget estimates included 1 spray for caterpillar pests. With better control in B2, current budget estimates include 2 sprays for stinkbugs only- no caterpillar sprays.

Summary and Conclusions

Due to yield differences and lack of an adequate replacement, the loss in income due to the expiration of single-gene Bollgard technology, and DP555BR specifically, was estimated at $36.55 million. The last year DP555BR and other single-gene varieties were fully available was 2009.

Since 2009, however, new B2 and W varieties and technologies have provided yields that rival DP555BR, especially in irrigated production. Fiber quality has also improved significantly.

B2 and W technology most often comes also bundled with Roundup-Ready Flex technology (B2RF and WRF) or Liberty-Link (B2LL) or Glytol/Liberty-Link (GLB2). Thus, the loss of single-gene (B1) technology also meant that growers would have to move to RF, LL, or GL technology for weed control.

B2RF, WRF, and LLB2 varieties were also available to growers prior to the expiration of single-gene varieties in 2009 but Georgia growers did not plant those varieties as long as DP555BR was still available. After the loss of 555, Georgia growers switched largely to new Deltapine (DP) varieties and Phytogen (PHY) varieties but the proportion of acreage planted to PHY increased significantly in 2012 and DP decreased due to increased planting of PHY499WRF—a high yielding variety. Both before and after the loss of 555, these examples show that yield continues to be the number one factor in variety selection. Perhaps signaling that growers feel they can make any technology fit and, thus, the choice of technology is secondary to yield potential.

The combined cost per acre of seed and technology fees is essentially the same for B2RF, WRF, and GLB2. The costs of weed control and insect control for B2RF and WRF is budgeted the same. Herbicides for GL are about $19 per acre higher than RF. Combined technology-related costs (seed, technology fees, herbicides, and insecticides excluding tillage and application) are estimated to be $155 to $177 per acre for 2013 compared to $116 per acre for DP555BR in 2009.

This increase is due to increased seed price, additional technology bundles and increased technology fees, and increased use of residual herbicides to control glyphosate resistant Palmer Amaranth. Newer technologies do, however, have value to the grower and add flexibility in weed and insect control.

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