Agronomic and Economic Consequences of Using Different Cotton Technology Systems in Alabama- A Two Year Summary

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Introduction

The vast majority of cotton in Alabama is now grown with genetically modified seed containing insect and weed resistance traits. Farmers pay for the cotton seed by the bag and then also pay a technology fee per bag for each trait contained in the seed. With seed treatments also added at planting, the large majority of a cotton farmer's costs are fixed once the cotton planter leaves the field. With little irrigation in Alabama, dry seasons with low cotton yields can be very economically damaging since the dryland farmer has no options to reduce production costs. Weed resistance is also an issue as more states report weed resistance to glyphosate (the trait incorporated in many current cotton varieties). A direct comparison of the different cotton technologies is needed so Alabama farmers can better evaluate their usefulness under Alabama growing conditions. A comparison using conventional cotton seed is critical so cotton growers can compare the economic benefits obtained from each cotton technology system.

Materials and Methods

Two test sites were established during the 2008 and 2009 growing seasons. Cotton was planted at the Tennessee Valley Research and Extension Center (TVREC) in northern Alabama and at the E.V. Smith Research Center (EVSRC) in central Alabama both seasons. The soil texture varied from a silt loam at the TVREC site to a sandy loam at the EVSRC site. Three cotton varieties representing three different cotton technology systems were grown each year. Each variety block was split by adding a pre-emergence herbicide application of Cotoran 4L (1 qt/A) + Prowl H2O (1 qt/A) to half the plot area at planting. Each system's weed control began by burning down all weeds with glyphosate at planting and in-season weeds were controlled only as needed. Variety blocks were again split by applying Heliothine control to half the plots when worm threshold levels were reached. Half the plots of all varieties received no worm control treatments. Final plot size was four to eight rows wide and 30-40 feet long. All other insects were scouted and controlled as threshold levels were reached. In 2008 cotton varieties Stoneville 4554 B2RF, Phytogen 485 WRF and CT 210 a conventional cotton variety were planted and evaluated. In 2009 Phytogen 485 WRF was replaced by Phytogen 440 W at each location so another herbicide control system could be evaluated.

Insect and weed control requirements varied greatly between the 2008 and 2009 growing seasons. The 2008 season saw above normal plant bug and Heliothine pressure at both test locations. At EVSRC, five insecticide applications for plant bugs and four larvicide applications for Heliothine were needed due to severe pressure. At the TVREC site in 2008 three larvicide applications for Heliothine control and three plant bug control applications were needed. At both locations a heavy mixture of budworms during the season required expensive chemistry to be used for worm control. In 2009 plant bug and Heliothine control pressure was much lighter, especially at TVREC. At TVREC one application for plant bugs and two applications for Heliothine control were applied. At EVSRC two plant bug and three Heliothine control applications were applied in 2009. Herbicide treatments were also more expensive at both locations in 2008 than in 2009. A later planting date in 2009 may have allowed cotton to out-grow many of the early season weed problems (especially early season grass pressure at TVREC) seen in 2008. The middle two to four rows were harvested for yields. Cotton quality was determined by ginning a 50 boll sample from each plot and using HVI analysis for color grade, staple, micronaire and uniformity.

Table 1. Average cotton yields, value, costs and return of three cotton technology systems conducted at the TVREC in 2008 and 2009.

Variety	Herb(Pre)	Larvicide	Lint/A	Lint/A	Value	Value	Costs **	Costs **	Returns **	Returns **
			2008	2009	2008	2009	2008	2009	2008	2009
			lb/A	lb/A	$/A	$/A	$/A	$/A	$/A	$/A
ST 4554	No	No	1920	1600	1042	907	162	125	880	782
ST 4554	No	Yes	1995	1576	1082	894	164	126	918	768
ST 4554	Yes	No	1995	1558	1079	880	155	137	924	743
ST 4554	Yes	Yes	1896	1473	1032	833	157	139	875	694
PHY*	No	No	1817	1301	985	740	160	93	825*	647*
PHY*	No	Yes	1999	1576	1081	867	162	95	919*	772*
PHY*	Yes	No	1933	1409	1045	798	153	105	892*	693*
PHY*	Yes	Yes	1964	1517	1062	860	155	107	907*	753*
CT 210	No	No	1068	1294	578	736	109	70	469	666
CT 210	No	Yes	1704	1550	923	883	146	88	777	795
CT 210	Yes	No	1376	1248	720	708	102	76	618	632
CT 210	Yes	Yes	1731	1465	941	834	139	94	802	740

* Phytogen 485 WRF was planted in 2008 and Phytogen 440W was planted in 2009
**Costs and returns include seed costs, technology fees, herbicide costs and insecticide costs. Other production costs are not included.

Table 2. Average cotton yields, value, costs, and returns of three cotton technology systems conducted at EVSRS in 2008 and 2009.

Variety	Herb(Pre)	Larvicide	Lint/A	Lint/A	Value	Value	Costs **	Costs **	Returns **	Returns **
			2008	2009	2008	2009	2008	2009	2008	2009
			lb/A	lb/A	$/A	$/A	$/A	$/A	$/A	$/A
ST 4554	No	No	2173	1489	1179	834	163	127	1016	707
ST 4554	No	Yes	2103	1435	1114	803	222	139	918	664
ST 4554	Yes	No	2220	1505	1189	843	168	133	1021	710
ST 4554	Yes	Yes	2082	1522	1125	852	227	145	898	707
PHY*	No	No	1805	1350	976	755	161	89	815	666
PHY*	No	Yes	1806	1367	982	765	220	100	762	665
PHY*	Yes	No	1951	1311	1056	734	166	93	890	641
PHY*	Yes	Yes	1805	1389	971	778	225	105	746	673
CT 210	No	No	1234	1292	661	723	108	65	553	658
CT 210	No	Yes	1507	1348	809	755	146	98	642	657
CT 210	Yes	No	1332	1244	715	696	102	70	608	626
CT 210	Yes	Yes	1380	1394	739	781	139	102	573	678

* Phytogen 485 WRF was planted in 2008 and Phytogen 440W was planted in 2009
**Costs and returns include seed costs, technology fees, herbicide costs and insecticide costs. Other production costs are not included.

Results and Discussion

Cotton Yields

Herbicide treatments generally had only a small effect on cotton yields during the two years of this study. Only at the TVREC site in 2008 did adding a pre-emergence herbicide treatment significantly increase yields and only with the CT 210 variety (Table 1). The CT 210 variety was noted both seasons at TVREC to have slower early season growth than any of the other cotton varieties. Grass pressure in 2008 also inhibited growth and stand of the CT 210 variety where pre-emergence herbicides were not applied. Although CT 210 also grew slowly in 2009, weed pressure was less at TVREC and yields were not affected by pre-emergence herbicides (Table 1).

As expected, larvicide applications on yields varied by variety. Larvicide application on the ST 4554 B2RF did not significantly increase cotton yields either year at either test site (Figures 1 and 2). The PHY 485 WRF variety planted in 2008 did respond with a significant yield increase to larvicide treatments at the TVREC site (Figure 1). The PHY 440 W variety also produced a large yield increase from one larvicide treatment at the TVREC site in 2009. Larvicide treatments did not significantly increase PHY 485 WRF or PHY 440 W yields at the EVSRC site (Figures 1 and 2). The conventional CT 210 variety, as expected, had the largest response to larvicide applications both seasons at both locations (Figures 1 and 2). When larvicides were applied at the TVREC site, all varieties produced equal yields except for lower yields with CT 210 in 2008. When larvicides were applied at the EVSRC site, however, yields of the PHY 485 B2RF, PHY 440 W and CT 210 were all significantly lower than ST 4554 B2RF both seasons (Figures 1 and 2). These differences are most likely due to greater Heliothine pressure at the EVSRC site compared to the TVREC site.

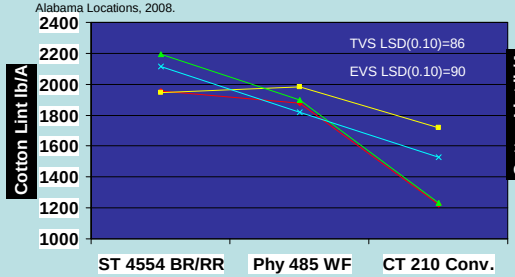
Economic Return

Economic value was calculated from lint yield and cotton loan value after HVI fiber analysis. Seed cost, technology fees, herbicide cost and insecticide costs were subtracted from the economic value resulting in a economic return. (Tables 1 and 2). Lint value was estimated for EVSRC in 2009 since fiber analysis was not complete. Economic returns were surprisingly similar during the two year study at TVREC. When larvicide applications were made to PHY 485 WRF and PHY 440 W both years and to CT 210 in 2009, yields and returns were almost identical to ST 4554 B2RF (Table 1). However, under heavy Heliothine pressure in 2008, the CT 210 variety had lower yields and returns were about 100 dollars less than the other varieties, even where larvicides were applied. At EVSRC in 2008, ST 4554 B2RF had higher yields and higher returns than either PHY 485 WRF or CT 210 (Table 2). In 2009 the economic return of PHY 440W and CT 210 , where larvicides were applied, were very similar to ST 4554 B2RF2 at the EVSRC site(Table 2).

Summary

The ST 4554 B2RF variety had the most consistent yields and returns over the two years at both test sites. The Phytogen varieties with Widestrike technology were high yielding and Heliothine control was generally good, but additional Heliothine control was required under heavy Heleothine pressure. The conventional CT 210 variety also produced similar yields if Heliothines were controlled. Surprisingly, returns to the farmer were very similar with each technology system tested. Only with the conventional CT 210 variety under heavy Heliothine pressure in 2008 were returns significantly decreased.

Figure 1. Effect of Cotton Variety and Larvicide Control on Cotton Lint Yields at Two Alabama Locations, 2008.



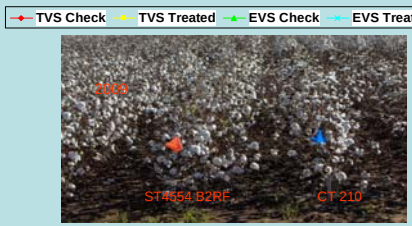


Figure 2. Effect of Cotton Variety and Larvicide Control on Cotton Lint Yields at Two Alabama Locations, 2009.