

# 2006 Arizona Upland Cotton Advanced Strain Testing Program

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## Abstract

*A series of experiments were conducted across three locations in Arizona to evaluate over 40 commercial cotton strains during the 2006 cotton growing season. These trials were conducted in Yuma, AZ (130 ft. above MSL); Maricopa, AZ (1170 ft. above MSL); and Safford, AZ (2900 ft. above MSL). Strains were planted in four row plots extending 38 feet in a randomized complete block design with a minimum of four replications. Each location had three commercial cotton varieties included as control treatments for comparison. Data collected on these trials included a series of plant measurements at three growth stages over the course of the season, yield and fiber quality data. All data was subjected to statistical analysis to test for differences among strains for yield and fiber quality. All three locations produced high yields despite high levels of heat stress in the lower deserts. Statistically significant differences were observed in yield and all fiber quality parameters at each location. Several lines performed considerably better than the commercial control varieties in terms of both yield and fiber quality indicating that continued progress is being made in developing new varieties that perform well in the varied cotton producing regions of Arizona.*

## Introduction

One of the most critical decisions a cotton producer will make during the course of the season is which variety is best suited to the region and growing style of a particular operation. With the advent of transgenic technologies and the introduction of new varieties that decision can be very difficult. The decision of a seed company to bring a variety to market and release it for general consumption is made after several years of testing through a breeding program. One of the last steps of a breeding program prior to commercial release is testing of the advanced strains across environments. This is one of the last opportunities for a seed company to evaluate a particular strain before release to the public and is critical for the development of varieties that are well-suited for the cotton producing regions of the United States. Arizona cotton growing conditions provide an excellent environment for seed production so it is in the best interest of the seed company to develop varieties that are well-suited to the hot, dry growing conditions of desert southwest.

The Arizona Upland Cotton Advanced Strains Testing Program provides critical, unbiased information to the seed company on the performance of varieties that will likely be grown in Arizona for seed production in the subsequent years. It also provides the Arizona cotton industry with an unbiased view of plant materials that are being considered for release into the public market before they are actually released. This situation provides an opportunity to influence the decisions as to which varieties will be advanced for release, helping to ensure high yielding and high fiber quality varieties for the Arizona cotton growing industry.

One of the unique aspects of this program is the range in conditions under which these strains are being evaluated. Three locations are selected for testing of these strains that range from slightly above sea level (100 ft, Yuma) to over 2800 ft elevation (Safford). This provides for an opportunity to examine the stability of the varieties across varying yield potential conditions.

## Materials and Methods

Three separate field trials were conducted in 2006 across the cotton producing regions of Arizona. These locations included Yuma (130 ft above MSL), Maricopa (1170 ft. above MSL), and Safford (2900 ft above MSL). Plots consisted of four rows wide and extended 38 feet in length. Row spacing varied among locations with 38, 40, and 42 inch row spacing at Safford, Maricopa, and Yuma respectively. All plots were arranged in a randomized complete block design with four replications. Plots were planted at a rate of 25 lbs of seed per acre. Upon post seedling emergence, all plots were thinned to a consistent stand of 3 to 4 plants per foot. Further details of each experiment are contained in Table 1.

A series of plant growth measurements were collected across all strains at each location three times over the course of the season. Data collected included plant height, number of mainstem nodes, position of first fruiting branch, number of aborted

or missing fruiting positions, and number of nodes above the top first position fresh bloom. This data allows for evaluation of plant growth and development, fruiting distribution, plant vigor, and progression toward maturity and is also critical in evaluating how a variety responds under a particular set of growing conditions.

Data collected at harvest included plot yield by harvesting the center two rows of each experimental unit. A 50 boll hand sample was collected from each experimental unit in a random fashion. This sample was used for determination of percent lint and seedcotton weight per boll which gives an indication of boll size. A large grab sample was also collected from each experimental unit from which fiber quality was determined by the USDA classing office in Phoenix, AZ. A premium or discount for each strain was determined based upon fiber quality data and the USDA CCC (Commodity Credit Corporation) loan schedule. This premium/discount was then applied to a base price of 52 cents/lb and a final crop value was calculated by multiplying the base price plus the premium/discount by the total lint yield of the strain.

All data collected was summarized and analyzed according to statistical procedures as outlined by the SAS Institute.

## **Results and Conclusions**

### **Yuma**

The Yuma location was originally planted on 13 February but due to inclement weather conditions within the first few days after planting poor emergence was observed in several varieties. A decision was made to remove the test and replant all varieties again on 13 March. An excellent stand was obtained and thinned to 3 to 4 plants per foot. Final lint yield for this test ranged from a low of just over 800 lbs lint/acre to over 1700 lbs. lint/acre. This test had a tremendous range in yield of nearly 1000 lbs. lint/acre. Some of the lower yields could be attributed to the significant levels of heat stress that began in late June and lasted through mid to later August. Crop maturity was complete by the end of July however some varieties may have been negatively impacted by the heat stress levels the last few weeks prior to cut-out. Several new varieties from Dyna-Gro performed well at the Yuma location. All lint yield and fiber quality data are presented in Table 2. Figures 1-3 provide graphical representations of the data outlined in Table 2. The black columns represent the control varieties entered into the test. Several lines performed significantly better than the standard control varieties in terms of yield and fiber quality. Only one line received a discount associated with fiber quality likely due to low micronaire and a 41 HVI color reading. Figure 4 displays a portion of the end of season plant measurement data collected including final plant height, total mainstem nodes, and average position of the first fruiting branch. Figures 5 and 6 illustrate respectively general trends in both percent fruit retention and height to node ratio or vigor. It is evident from Figure 6 that this crop experienced a high degree of vigor the entire season. However this high vigor was not at the expense of fruit load. Figure 5 indicates high levels of fruit retention among nearly all lines with end of season levels averaging around 50 percent.

### **Maricopa**

As discussed earlier, high levels of heat stress plagued the low deserts of Arizona with Maricopa experiencing those levels from late June through late August. However, this particular trial location did not seem to be as negatively impacted in 2006 as it was in 2005. Lint yield this year ranged from around 1500 lbs. lint/acre to over 2000 lbs. lint/acre. The crop was carried out further than normal with the final irrigation being applied near the end of September. Lint yield and fiber quality data are presented in Table 3 with graphical representations of the data found in Figures 7-9. One of the control varieties, DP164B2RF performed well at Maricopa as it did commercially around the state. However several new lines performed nearly as well as that standard. It is also interesting to note that several new lines and the DP164B2RF performed significantly better than the long standing standard for DP449BR, indicating progression of new varieties with higher yield potential and excellent fiber quality. Fiber quality for the Maricopa location was generally adequate. However, several lines received fiber quality discounts primarily due to leaf grade. This likely arose due to the fact that the crop was carried out longer than usual and difficulty in defoliation occurred resulting in higher than normal levels of leaf grade classifications. Figure 10 shows end of season plant measurement data for this location with Figures 11 and 12 showing season long trends in plant fruit load (Figure 11) and plant vigor (Figure 12). Generally speaking, fruit retention levels were at or above normal levels during the entire season with end of season levels above average. This high level of fruit load resulted in generally lower than average crop vigor for almost all lines during the season.

## **Safford**

Conditions in the Safford valley were again ideal for cotton production during 2006. Higher than normal summer temperatures result in adverse conditions in the lower deserts of Arizona but result in optimum conditions for the higher elevations of the Safford valley. Lint yields ranged from 1200 to over 1900 lbs./acre. Mean separations and fiber quality listings are displayed in Table 4 with graphical representations of the data in Figures 13-15. End of season plant measurements are found in Figure 16. Plant measurements revealed extremely high levels of fruit retention along with high levels of crop vigor throughout the entire season resulting in a high yielding crop (Figures 17-18). Only one (Phytogen P03X4088) line received a discount due to fiber quality which was due to lower staple and higher leaf grade (Table 4). An interesting trend that was observed at the Safford location as compared to the other locations was that lines that tended to perform poorer in the lower desert are generally those that perform well in the higher elevations of the Safford Valley. These trials allow for this unique comparison due to the contrasting environmental conditions among the three locations.

Table 1. Planting, plant measurement, and harvest dates for each advanced strain evaluation location. Eight commercial seed companies entered several strains at each location.

<b>Location:</b>	<b>Yuma</b>	<b>Maricopa</b>	<b>Safford</b>
<b>Planting Date:</b>	20 March 2006	19 April 2006	26 April 2006
<b>Plant Measurement Sample Dates</b>	30 May 2006 20 June 2006 25 July 2006	6 June 2006 14 July 2006 9 August 2006	27 June 2006 12 August 2006 16 September 2006
<b>Harvest Date:</b>	13-14 August 2007	28-29 November 2006	12-13 November 2006
<b>Entered Strains</b>			
<b>Deltapine</b>			
DPLX04T105DF	X		
DPLX04T153F	X		
DPLX04X429DF	X		
DPLX04Z530F	X		
DPLX06W650F	X	X	X
DPLX06W660F	X	X	X
DPLX06X058F	X		
<b>Stoneville</b>			
STX0503RF			X
STX0504RF		X	X
STX0505B2RF			X
<b>Phytogen</b>			
P02X3003		X	X
P02X5068		X	X
P03X3026		X	X
P03X3043		X	X
P03X4088		X	X
P03X4094		X	X
P03X4107		X	X
P03X5077		X	X
P03X7040			X
P03X7082			X
<b>FiberMax</b>			
FM9058F		X	
FM9060F	X	X	
FM9063B2R		X	X
FM9068F		X	
FM955LLB2	X	X	X
FM960B2R	X	X	X
FM965LLB2	X	X	X
FM988LLB2	X	X	X
FM989B2R	X	X	X
<b>Salcot</b>			
SCX 16		X	X
SCX 17		X	X
SCX 246		X	X
<b>Arizona Cotton Growers Association</b>			
0101-2161-304	X	X	X
0101-2165-305	X	X	X
0112-2006-302	X	X	X
0112-2006-307	X	X	X
0116-2009-307	X	X	X
0116-2011-309	X	X	X
0116-2012-306	X	X	X
0122-2015-305	X	X	X
0122-2030-303	X	X	X
0122-2053-301	X	X	
<b>CPCSD</b>			
CS37	X	X	X
CS38			X
CS44	X	X	X
CS45	X	X	X
CS46	X	X	X
CS47	X	X	X
CS48	X	X	X
CS49	X	X	X
CS50	X	X	X
CS51		X	X
<b>Dyna-Gro</b>			
DG2100B2RF	X	X	X
DG2215B2RF	X	X	X
DG2242B2RF	X	X	X
DG2520B2RF	X	X	X

Table 2. Lint yield and fiber quality results for the advanced strain trial conducted in Yuma, AZ, 2006.

Seed Company	Strain		Lint Yield	Means Separation*	Lint Turnout	HVI Color	Staple	Strength	Uniformity	Micronaire	Seedcotton Weight/boll	Premium	Value
			lbs/acre		Percent		32nds	g/tex	Percent		(g)	cent/lb	\$/acre
Dyna-Gro	DG2100B2RF	G2100B2F	1704.2	a	40.8	11	35.3	28.5	81.6	3.93	4.8	5.80	985.05
CPCSD	CS44	CS44	1688.7	a	41.6	11	36.5	30.0	80.5	4.15	5.3	6.41	986.57
Dyna-Gro	DG2520B2RF	G2520B2F	1675.5	a	40.7	11	36.3	27.0	81.4	4.03	5.2	7.05	989.42
Dyna-Gro	DG2215B2RF	G2215B2F	1588.9	a b	38.7	11	35.5	27.8	81.3	3.55	4.9	5.45	913.03
Delta and Pine	DPLX06W660F	D6W660F	1566.9	a b	43.7	11	36.3	29.2	81.4	4.48	5.3	5.39	901.13
CPCSD	CS48	CS48	1561.0	a b	40.6	11	37.8	30.2	81.1	4.38	5.2	7.29	925.48
AZ Cotton Growers	0101-2165-305	ACGA85	1497.5	b c	39.4	11	36.0	30.6	82.6	3.73	4.8	6.88	882.31
CPCSD	CS49	CS49	1475.7	b c	40.2	11	35.8	28.2	81.3	4.13	4.9	5.99	853.89
Dyna-Gro	DG2242B2RF	G2242B2F	1473.4	b c	40.1	11	36.3	28.4	81.4	4.18	4.9	7.04	869.85
AZ Cotton Growers	0101-2161-304	ACGA84	1461.3	b c d	39.2	11	37.3	32.2	82.3	4.10	4.8	7.64	871.57
CPCSD	CS37	CS37	1458.9	b c d	38.5	11	37.3	32.5	81.2	3.90	4.6	7.69	870.80
CPCSD	CS46	CS46	1403.4	c d e	40.0	21	36.5	32.2	82.1	4.28	4.9	6.81	824.45
Control	DP432R	DP432R	1383.7	c d e f	41.3	22	36.8	31.0	82.1	4.35	4.9	3.61	769.30
CPCSD	CS45	CS45	1379.7	c d e f	38.7	21	37.5	32.4	81.7	3.93	4.6	7.61	822.48
Delta and Pine	DPLX06W650F	D6W650F	1379.5	c d e f	41.5	11	36.0	29.8	81.5	4.20	4.6	7.13	815.90
AZ Cotton Growers	0122-2015-305	ACGA91	1360.4	c d e f	38.4	11	36.5	31.4	81.6	3.75	4.8	7.49	809.21
AZ Cotton Growers	0122-2030-303	ACGA92	1309.5	d e f g	39.6	21	36.3	32.5	82.4	3.90	5.5	7.50	778.83
Control	DP164B2F	DP164B2F	1299.6	e f g	39.0	21	37.8	30.7	82.4	3.70	4.4	7.56	774.17
Delta and Pine	DPLX04T153F	D4T153F	1244.6	f g h	41.7	21	37.5	30.3	81.0	3.43	4.5	5.50	715.22
FiberMax	FM965LLB2	F965LLB2	1177.9	g h i	36.9	11	36.5	31.2	81.7	3.85	5.5	7.48	700.50
AZ Cotton Growers	0122-2053-301	ACGA93	1153.9	g h i	38.5	11	36.8	30.9	82.4	4.20	4.1	7.41	685.61
Delta and Pine	DPLX04Z530F	D4Z530F	1137.7	h i j	38.3	41	38.0	34.7	83.4	4.03	4.8	-0.83	582.36
Delta and Pine	DPLX06X058F	D6X058F	1133.7	h i j	43.6	31	37.3	29.3	81.5	4.03	5.1	4.45	640.85
Delta and Pine	DPLX04T105DF	D4T105DF	1133.4	h i j	40.0	21	38.8	30.1	82.3	3.60	4.4	5.86	655.70
AZ Cotton Growers	0116-2011-309	ACGA89	1132.1	h i j	35.7	11	38.3	32.2	81.4	3.53	4.6	7.00	667.94
FiberMax	FM989B2R	F989B2R	1123.8	h i j	36.7	11	37.3	32.5	82.3	3.78	5.3	7.41	667.88
AZ Cotton Growers	0116-2012-306	ACGA90	1117.3	h i j	36.6	22	36.8	30.9	82.0	4.25	6.0	3.39	619.18
CPCSD	CS47	CS47	1101.0	h i j k	39.4	11	37.0	30.7	81.2	3.78	5.1	7.33	652.99
FiberMax	FM9060F	F9060F	1096.7	h i j k l	39.2	21	37.5	30.1	80.9	3.55	5.1	5.83	634.22
Delta and Pine	DPLX04X429DF	D4X429DF	1073.0	i j k l	38.9	11	37.3	31.0	81.4	3.58	4.2	7.04	633.59
AZ Cotton Growers	0116-2009-307	ACGA88	1056.3	i j k l	36.4	21	38.8	32.3	82.0	3.60	4.4	7.48	628.24
AZ Cotton Growers	0112-2006-302	ACGA86	1031.6	i j k l	40.6	21	37.0	31.2	80.6	3.60	3.6	6.51	603.38
AZ Cotton Growers	0112-2006-307	ACGA87	997.7	j k l	39.6	11	37.0	28.1	79.3	3.65	3.9	6.41	582.67
FiberMax	FM960B2R	F960B2R	990.5	j k l	38.0	11	36.8	31.3	81.0	3.95	5.1	7.35	587.66
CPCSD	CS50	CS50	947.8	k l m	40.4	22	36.8	31.0	81.3	4.08	4.3	3.33	524.31
FiberMax	FM955LLB2	F955LLB2	942.6	l m	36.8	21	38.0	30.1	82.0	3.88	5.9	7.40	560.01
FiberMax	FM988LLB2	F988LLB2	811.8	m	36.9	11	37.5	32.5	81.1	3.68	5.3	7.53	483.21
LSD§			155.9		1.3	---	0.9	1.7	1.3	0.28	0.7	1.78	86.12
OSL†			0.0001		0.0001	---	0.0001	0.0001	0.0003	0.0001	0.0001	0.0001	0.0001
CV‡			8.7		2.4	---	1.7	3.9	1.2	5.0	10.9	19.8	9.2

\*Means followed by the same letter are not statistically different according to a Fisher's least significant difference means separation test.

§ Least Significant Difference

† Observed Significance Level

‡ Coefficient of Variation













































