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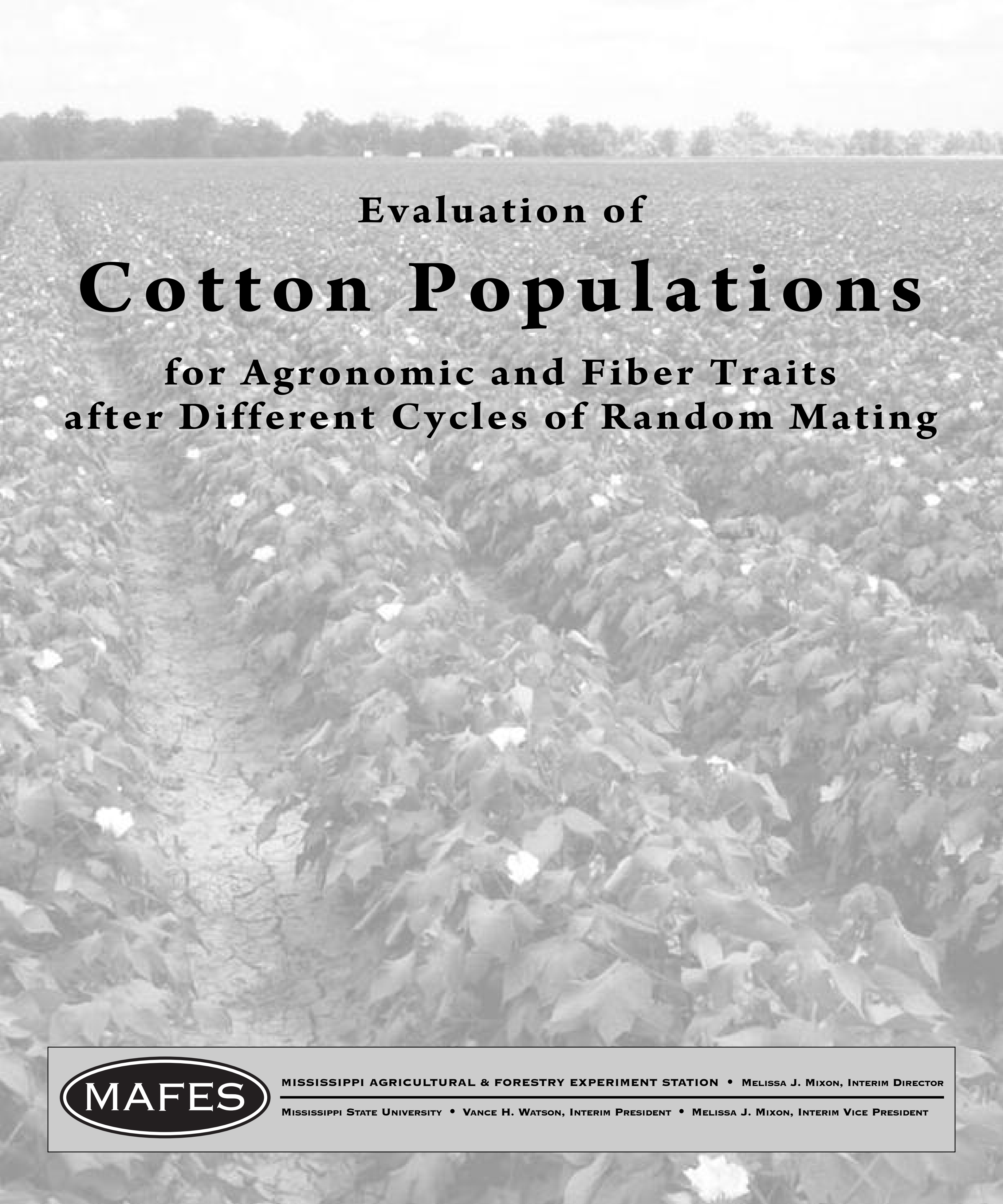

Evaluation of Cotton Populations for Agronomic and Fiber Traits after Different Cycles of Random Mating

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MISSISSIPPI AGRICULTURAL & FORESTRY EXPERIMENT STATION • MELISSA J. MIXON, INTERIM DIRECTOR

MISSISSIPPI STATE UNIVERSITY • VANCE H. WATSON, INTERIM PRESIDENT • MELISSA J. MIXON, INTERIM VICE PRESIDENT

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Jack C. McCarty
Crop Science Research Laboratory
USDA-ARS
Mississippi State University

Johnie N. Jenkins
Crop Science Research Laboratory
USDA-ARS
Mississippi State University

Jixiang Wu
Department of Plant and Soil Sciences
Mississippi State University

Osman A. Gutiérrez
Department of Plant and Soil Sciences
Mississippi State University

Russell Hayes
Crop Science Research Laboratory
USDA-ARS
Mississippi State University

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Abstract

Random mating, as one of several breeding approaches, has been used to successfully break linkage blocks in crops for multiple-trait improvements. In this study, we used 11 cotton (*Gossypium hirsutum* L.) lines from diverse breeding programs as parents to make 55 F_2 populations and 55 corresponding populations with cycles of random mating ranging from 1 to 4. The parents, F_2, and random-mated populations were grown and evaluated in field plots in 2005 at Mississippi State University. Generally, the results showed that parents had larger variances and ranges for agronomic and fiber traits measured than F_2 hybrids and their corresponding populations at different cycles of random mating. The genetic variances among 55 F_2 populations decreased with increased cycles of random mating. In general, the mean for parents showed significant differences from the mean of the populations at different cycles of random mating for most traits measured; however, F_2 populations did not differ among different cycles for most traits. High correlations were detected among traits for parents and F_2 populations, but correlations among traits decreased with increased cycles of random mating. Higher correlations between F_2 and random-mated cycle 1 (C_0S_1) were detected than those among other random-mated cycles for most traits. The results indicated that the linkage blocks have been broken after one to four cycles of random mating. The random mating populations should provide a genetic resource for selecting lines with improved agronomic and fiber traits.

Introduction

Simultaneous enhancement of multiple characters like yield and quality is an important objective for crop breeders. High-yielding upland cotton (*Gossypium hirsutum* L.) cultivars are usually associated with average fiber quality traits such as length and strength (Meredith, 1984). For a long time, this negative genetic association between yield and fiber quality has greatly hampered effective cotton improvement through the classical plant breeding method of crossing, selfing, and selecting. Therefore, the employment of an efficient approach to break down such unfavorable genetic associations is of great importance.

The random-mating procedure, which is different from the classical breeding approach, has provided an important means to effectively break the negative associations between yield and quality in several self-pollinated crops like tobacco (*Nicotiana tabacum* L.) (Humphrey et al., 1969), sorghum (*Sorghum bicolor* L. Moench) (Nordquist et al., 1973), soybean (*Glycine max* L. Merr.) (Burton and Brim, 1981), and oats (Frey and Holland, 1999). Random mating has also been successfully used in cotton to break linkages between genes responsible for fiber strength and yield (Miller and Rawlings, 1967). For example, hybridization of two parents followed by five generations of intercrossing improved yield by 9% while maintaining fiber strength. The random-mating procedure also has been used successfully in maize (*Zea mays* L.), a cross-pollinated crop (Covarrubias-Prieto, 1987). These studies suggest the success of using a random-mating procedure in the improvement of multiple traits that are negatively associated.

In most cases, random-mating schemes have involved hand-pollination. When few parents are used, this may be easy to handle; however, with more than three parents involved, this method becomes tedious and time-consuming. Miravalle (1964) proposed a bulked-pollen method for intermating cotton populations and described his method using four different cotton strains. A random population involving a large number of parents can provide a better chance to combine multiple traits (genes) of interest that come from different parental lines.

In our study, we used a set of 11 diverse parental lines to make a diallel cross producing 55 hybrids. We randomly mated each population as female using bulked pollen collected from the 55 populations following the method described by Gutierrez et al. (2006). This process continued for four cycles of random mating. These entries were planted at Mississippi State University in 2005. Nine agronomic and fiber traits were measured for each of five different generations (F_2, C_0S_1, C_1S_1, C_2S_1, and C_3S_1, respectively). These nine traits were compared after the first cross and four cycles of random mating. Correlation coefficients among traits at each cycle of random mating and among different cycles of random mating for each trait were evaluated. Multiple comparisons among different populations at different cycles of random mating also were conducted. Research provides a detailed insight of the breakup of genetic associations among traits and thus should provide valuable information and base populations for multiple-trait improvement in cotton breeding programs.

Materials and Methods

Materials and Experiments

Eleven parental lines were used in this study: (1) Acala Ultima, (2) Tamcot Pyramid (Pyramid), (3) Coker 315 (C315), (4) Stoneville 825 (ST825), (5) FiberMax 966 (FM966), (6) M-240 RNR (M240), (7) Paymaster HS26 (HS26), (8) Deltapine Acala 90 (DP90), (9) Phytogen PSC 355 (PSC355), (10) Sure-Grow 747 (SG747), and (11) Stoneville 474 (ST474) (Table 1). These 11 parents were selected to represent diverse breeding programs with acceptable agronomic and fiber traits. A set of half-diallel crosses among these parents (55 crosses) was handmade in the summer of 2002. The 55 crosses (F_1 seeds) were sent to a nursery in Mexico for random mating and to produce F_2 seeds during the winter of 2002-03.

Following is a description of how the random-mated cycles were developed. During the winter of 2002-03 at the nursery in Mexico, each of the 55 crosses was grown in a single row (15 hills, two plants per hill). When plants started to flower, crosses were initiated. Each day, two prebloom (candle-stage) buds were covered with a cloth bag on each of the 55 rows. Also daily, approximately 10 candle-stage buds were emasculated (anthers removed) on each row, and each stigma was covered with a soda straw. On the following morning, the blooms that had been covered with bags on the previous day were collected. Pollen was collected from these blooms and completely mixed. The mixed pollen was used to pollinate emasculated buds on each of the 55 rows. This procedure was repeated each day until approximately 100 emasculated flowers

Table 1. Parents used to develop random-mating populations.

Parent	Designation	Developer	Reference[1]
Acala Ultima	Acala U	CPCSD, Shafter, CA	MAFES Bull. 1155 (2006)
Tamcot Pyramid	Pyramid	Texas Agric. Exp. Stn.	Crop Sci. 44:343 (2004)
Coker 315	C315	Coker Pedigreed Seed Co., Hartsville, SC	MAFES Bull. 1155 (2006)
Stoneville 825	ST825	Stoneville Pedigreed Seed Co., Stoneville, MS	MAFES Bull. 1155 (2006)
FiberMax 966	FM966	Bayer Crop Science	MAFES Bull. 1155 (2006)
M-240 RNR	M240	USDA-ARS	Crop Sci. 36:820 (1996)
Paymaster HS26	HS26	Paymaster Technologies, Inc., Aiken , TX	MAFES Bull. 1155 (2006)
Deltapine Acala 90	DP90	Delta & Pine Land Co., Scott, MS	MAFES Bull. 1155 (2006)
Sure-Grow 747	SG747	Sure-Grow, Leland, MS	MAFES Bull. 1155 (2006)
Phytogen PSC 355	PSC355	Miss. Agric & Forestry Exp. Stn. [2]	MAFES Bull. 1155 (2006)
Stoneville 474	ST474	Stoneville Pedigreed Seed Co., Stoneville, MS	MAFES Bull. 1155 (2006)

[1]Provides Pedigree information.
[2]Licensed to Phytogen Seed Company.

had been pollinated on each row. When crossed bolls were open, they were hand-harvested and bulked for each row. The harvested seed was labeled as random-mated cycle C_0.

The 55 random-mated cycle C_0 populations were grown in single-row plots (80 feet with approximately 60 plants) at Mississippi State during the summer of 2003. The random-mating crossing procedure described in the previous paragraph was followed during the crossing period. The harvested crossed bolls were labeled as random-mated cycle C_1. This random-mating procedure was repeated, alternating between the Mexico Winter Nursery and Mississippi State, until cycle C_3 was complete. The initial crosses (F_1) and random-mated cycles C_0, C_1, C_2, and C_3 were grown at the winter nursery and self-pollinated, resulting in F_2, C_0S_1, C_1S_1, C_2S_1, and C_3S_1 seed being produced. The timeline and populations developed are provided in Table 2.

In 2005, the F_2 and four cycles of mating, 11 parents, and five bulked populations each from 55 F_2, C_0S_1, C_1S_1, C_2S_1, and C_3S_1 were planted at Mississippi State. The bulk populations were constructed by pooling equal numbers of seed from each of the 55 populations. Due to the large number of entries in this experiment, we divided these entries into five groups with each group including 55 populations (F_2, C_0S_1, C_1S_1, C_2S_1, or C_3S_1), 11 parents, and five bulked populations. In each group, a randomized complete block design with four replications was applied. Plot size was a single row 12 meters in length with row spacing of 0.97 meter. The planting was a solid-row pattern. The stand density consisted of single plants spaced approximately 10 centimeters apart. The soil was a Leeper silty clay loam (Fine, smectitic, nonacid, thermic Vertic Epiaquept). Planting date was May 13, 2005, and machine harvest date was October 18, 2005.

Normal field cultural practices were followed during the cotton-growing season. Before machine harvest, a 25-boll sample from each plot was collected to determine the boll weight (BW) and lint percentage (LP). Seed cotton yield (YLD), measured in kilograms per hectare (kg/ha), was converted from plot weights. Lint yield (LY), also measured in kg/ha, was calculated based on seed cotton yield and lint percentage. The ginned lint samples were sent to STARLAB, Inc., of Knoxville, Tennessee, where fiber quality measurements were determined by high-volume instrument (HVI) testing. Five measurements were made: (1) micronaire (MIC), a measure of fiber fineness or maturity by resistance to air flow, which is reported in standard micronaire units; (2) elongation (ELO), the degree of extension or stretch of fibers before breaking during strength measurement, reported as a percent; (3) strength (STR), the force required to break a bundle of fibers with holding jaws separated by 1/8 inch, reported in grams per tex; (4) length (LEN), the average of the longest 50% of fibers in the sample, reported in hundredths of an inch and converted to millimeters in this manuscript; and (5) fiber uniformity (UR), the ratio of the average length of all fibers to the average length of the longest 50% of the fibers in the sample, reported as a percent (Anonymous, 2001).

Table 2. Scheme of random-mating population development.

Year	Description	Seed harvested	Location	Time
2002	Plant 11 parents and made diallel F_1 crosses	F_1 diallel	Miss. State, MS	Summer
2002-03	1. Plant F_1 diallel crosses in Mexico and random mated 2. Plant F_1 in Mexico and selfed	1.Cycle 0 (C_0) 2. F_2	Mexico	Winter/Spring
2003	Plant C_0 seed and made random mating	Cycle 1 (C_1)	Miss. State, MS	Summer
2003-04	1. Plant C_1 seed and made random mating 2. Plant C_0 and selfed 3. Plant C_1 and selfed	1. Cycle 2 (C_2) 2. Selfed C_0 (C_0S_1) 3. Selfed C_1 (C_1S_1)	Mexico	Winter/Spring
2004	Planted C_2 seed and made random mating	Cycle 3 (C_3)	Miss. State, MS	Summer
2004-05	1. Plant C_1 seed and selfed 2. Plant C_2 seed and selfed 3. Plant C_3 seed and selfed	1. Selfed C_1 (C_1S_1) 2. Selfed C_2 (C_2S_1) 3. Selfed C_3 (C_3S_1)	Mexico	Winter/Spring
2005	Plant F_2, C_0S1, C_1S1, C_2S_1, C_3S_1, F_2 bulk, C_0 bulk, C_1 bulk, C_2 bulk, and C_3 bulk, and parents		Miss. State, MS	Summer

Statistical Analysis

The phenotypic data were analyzed by generations (parents and F_2) and by entries (66 entries) subject to the ANOVA models. Mean values for each of two generations and for each of 66 entries were calculated accordingly with least significant difference (LSD) at 0.05 probability level. Correlation coefficients among traits at each generation and among generations for each trait were calculated. This part of data analysis was conducted by SAS 9.0 (SAS Institute, Inc., 2001).

Results

Descriptive statistics for parents, 55 populations with different cycles of random mating

On average, parents had slightly shorter fibers, weaker fibers, lower boll weight, and lower seed cotton yield and lint yield than F_2 hybrids, C_0S_1, C_1S_1, C_2S_1, and C_3S_1 populations, indicating positive heterosis among many of these populations (Table 3). The parents had slightly greater values than these 55 populations for fiber uniformity, fiber elongation, fiber micronaire, and lint percentage at different random-mating cycles ranging from C_0 to C_3.

The standard deviation for the traits measured was larger for parents than that for the F_2 and cycles of random mating. The standard deviations for F_2 populations were second in magnitude to parents. It appeared that after at least two cycles of random mating, the standard deviations for these traits appeared stable (Table 3).

The ranges among these 11 parents were the largest for all traits, and generally the ranges among these 55 populations tended to be smaller with increasing cycles of random mating as we expected (Table 3).

Table 3. Descriptive statistics for nine fiber and agronomic traits.[1]

	LEN	UR	STR	ELO	MIC	LP	BW	YLD	LY
					Parents				
Mean	28.53	82.89	29.95	8.51	4.93	40.45	4.87	2107	855
SD	1.05	0.75	2.00	0.53	0.29	1.87	0.43	514	221
Minimum	26.29	81.25	26.63	7.63	4.00	36.42	4.05	742	284
Maximum	31.12	84.73	34.50	9.56	5.40	43.95	5.87	3360	1422
					F_2 Population				
Mean	28.93	82.79	30.37	8.34	4.83	40.56	5.05	2229	904
SD	0.78	0.75	1.91	0.31	0.22	1.06	0.4	392	162
Minimum	27.37	81.08	27.53	7.68	4.45	38.23	4.28	1340	523
Maximum	30.61	84.3	35.88	8.98	5.45	42.61	5.99	3252	1296
					C_0S_1 Population				
Mean	28.88	82.63	30.19	8.31	4.85	40.33	5.03	2214	893
SD	0.54	0.55	1.28	0.18	0.18	0.80	0.28	429	175
Minimum	27.5	81.2	27.9	7.78	4.45	38.71	4.43	1307	518
Maximum	30.42	83.73	33.7	8.73	5.33	41.93	5.53	3253	1363
					C_1S_1 Population				
Mean	28.94	82.69	30.16	8.29	4.88	40.26	5.07	2262	911
SD	0.41	0.46	0.96	0.18	0.17	0.76	0.28	382	156
Minimum	27.69	81.55	28.00	7.85	4.43	37.83	4.33	1286	521
Maximum	29.72	83.53	32.85	8.65	5.35	42.35	5.47	2990	1211
					C_2S_1 Population				
Mean	28.89	82.65	29.98	8.31	4.89	40.41	5.05	2203	890
SD	0.39	0.47	0.96	0.14	0.15	0.62	0.26	306	125
Minimum	28.13	81.75	28.33	8.05	4.58	38.87	4.31	1527	618
Maximum	29.72	83.9	32.1	8.68	5.23	41.87	5.63	2826	1144
					C_3S_1 Population				
Mean	28.88	82.61	30.16	8.29	4.87	40.2	5.09	2216	891
SD	0.38	0.54	0.86	0.14	0.15	0.66	0.26	365	148
Minimum	28.07	81.13	28.3	7.95	4.55	38.75	4.5	1153	472
Maximum	29.65	83.7	32.63	8.73	5.3	41.54	5.65	2844	1145

[1]LEN = fiber length (mm), UR = fiber uniform ratio (%), STR = fiber strength (g/tex), ELO = fiber elongation (%), MIC = micronaire, LP = lint percentage (%), BW = boll weight (g), YLD = seed cotton yield (kg/ha), and LY = lint yield (kg/ha).

Comparisons among five bulked populations and with 55 populations at different cycles of random mating

In the present study, the five bulked populations, each equally mixed from 55 populations at different cycles of random mating, were also grown in each of five groups due to possible field variations. Multiple comparisons of these five bulked populations and the mean of 55 populations at each cycle of random mating were conducted for each group. As we expected, results showed that the five mixed populations and mean of 55 populations did not differ with regard to all traits measured except fiber strength in group 2, lint percentage in group 3, boll weight in group 4, and micronaire and lint percentage in group 5 (data not shown). The occurrence of these exceptional cases was probably due to genetic sampling of seeds. However, the mean of 55 populations was significantly different from the mean of 11 parents for most traits in each of five groups (Table 4). Thus, these results suggested that additive and dominance effects were mainly responsible for most of these traits measured. However, the results also indicated the genetic sampling might cause the slight inconsistence in this study.

Table 4. Generation means for nine fiber and agronomic traits over four replications.[1]

Replication		LEN	UR	STR	ELO	MIC	LP	BW	YLD	LY
1	P	28.50	83.04	29.80	8.46	4.97	40.67	4.82	2005.2	817.0
	F_2-bulk	28.92	82.79	30.36	8.34	4.84	40.56	5.05	2228.9	904.4
	LSD 0.05	0.21	0.26	0.51	0.10	0.08	NS	0.09	188.6	77.1
2	P	28.57	83.00	30.11	8.52	4.94	40.23	4.87	2313.4	936.9
	C_0S_1	28.88	82.63	30.19	8.31	4.84	40.33	5.03	2214.4	893.1
	LSD 0.05	0.20	0.28	NS	0.09	0.08	NS	0.09	NS	NS
3	P	28.36	82.61	29.70	8.56	4.95	40.58	4.86	2133.9	867.7
	C_1S_1	28.94	82.68	30.16	8.29	4.88	40.26	5.07	2261.6	910.7
	LSD 0.05	0.19	NS	NS	0.09	0.08	0.29	0.11	178.7	72.0
4	P	28.61	82.87	30.08	8.51	4.90	40.24	4.93	2031.2	820.3
	C_2S_1	28.89	82.64	29.98	8.31	4.89	40.41	5.05	2202.6	890.2
	LSD 0.05	0.18	0.23	NS	0.09	NS	NS	0.09	202.0	81.9
5	P	28.60	82.91	30.05	8.49	4.90	40.52	4.86	2052.9	831.6
	C_3S_1	28.88	82.60	30.16	8.29	4.87	40.20	5.09	2216.4	891.2
	LSD 0.05	0.20	0.27	NS	0.09	NS	0.28	0.10	188.2	75.6

[1]LEN = fiber length (mm), UR = fiber uniform ratio (%), STR = fiber strength (g/tex), ELO = fiber elongation (%), MIC = micronaire, LP = lint percentage (%), BW = boll weight (g), YLD = seed cotton yield (kg/ha), and LY = lint yield (kg/ha).

Correlations at parent and different cycles of random mating

Parent

Regarding parents, fiber length was significantly correlated with uniformity ratio (0.86), fiber strength (0.50), elongation (-0.58), micronaire (-0.58), and lint percentage (0.63) (Table 5). Uniformity ratio was significantly correlated with fiber strength (0.56), elongation (-0.33), micronaire (-0.45), lint percentage (0.35), and boll weight (0.29). Fiber strength was significantly correlated with micronaire (-0.42) and boll weight (0.55). Elongation was significantly correlated with micronaire (0.56) and lint percentage (-0.31). Micronaire was correlated with boll weight (-0.44). Lint percentage was significantly correlated with lint yield (0.42). Lint yield and seed cotton yield were highly correlated with a coefficient of 0.98.

F_2 Population

At the F_2 generation, fiber length was significantly correlated with uniformity ratio (0.75), fiber strength (0.69), micronaire (-0.51), lint percentage (0.56), seed cotton yield (0.32), and lint yield (0.29) (Table 5). Uniformity ratio was correlated with fiber strength (0.53) and lint percentage (0.49). Fiber strength was correlated with micronaire (-0.36), lint percentage (0.39), and boll weight (0.48). Elongation was correlated with micronaire (0.43). Lint yield and seed cotton yield had a high correlation (0.99).

C_0S_1 Population

After one cycle of random mating, fiber length had significant correlations with uniformity ratio (0.61), fiber strength (0.46), and micronaire (-0.48). Uniformity ratio had significant correlations with fiber strength (0.54) and fiber elongation (0.44). Fiber strength was correlated with fiber elongation (0.39) and boll weight (0.34). Fiber elongation was significantly correlated with micronaire (0.43). Seed cotton yield had correlations with boll weight (0.33) and lint yield (0.99).

C_1S_1 Population

After two cycles of random mating, fiber length had significant correlations with uniformity ratio (0.62), fiber strength (0.31) and lint percentage (0.28) (Table 5). Uniformity ratio was significantly correlated with fiber strength and lint percentage. Fiber strength had correlations with fiber elongation (0.47). Fiber elongation was significantly correlated with micronaire (0.40). Micronaire was negatively correlated with lint percentage (-0.37). Boll weight was positively correlated with seed cotton yield (0.39) and lint yield (0.37). Lint yield and seed cotton yield had a high correlation (0.99).

C_2S_1 Population

After three cycles of random mating, uniformity ratio was correlated with fiber length (0.55) and fiber strength (0.50) (Table 5). Elongation had significant correlations with fiber strength (0.44), micronaire (0.28), and lint percentage (0.27). Micronaire was correlated with lint percentage (0.33). Lint yield and seed cotton yield had a high correlation (0.99).

C_3S_1 Population

After four cycles of random mating, fiber length was correlated with uniformity ratio (0.50), seed cotton yield (0.33), and lint yield (0.32) (Table 5). Uniformity ratio had significant correlations with fiber strength (0.28), fiber elongation (0.29), and boll weight (0.50). Fiber strength was correlated with elongation (0.30) and boll weight (0.34). Fiber elongation was correlated with micronaire (0.40) and lint percentage (0.27). Micronaire was correlated with lint percentage (0.43) and boll weight (0.31). Lint percentage and boll weight were positively correlated (0.29). Boll weight was positively correlated with seed cotton yield (0.37) and lint yield (0.39). Lint yield and seed cotton yield had a high correlation (0.99).

In summary, high correlations were detected among traits for parents and F_2 populations while decreasing with increased cycles of random mating, indicating that linkage blocks among these traits might have been broken.

Table 5. Correlations among nine traits for parents and bulked populations.[1]								
	UR	STR	ELO	MIC	LP	BW	YLD	LY
				Parents				
LEN	0.86	0.50	-0.58	-0.58	0.63	0.22	0.01	0.08
UR		0.56	-0.33	-0.45	0.35	0.29	-0.08	-0.02
STR			-0.19	-0.42	-0.10	0.55	-0.14	-0.15
ELO				0.56	-0.31	-0.25	0.08	0.02
MIC					0.02	-0.44	0.26	0.26
LP						-0.20	0.25	0.42
BW							-0.08	-0.11
YLD								0.98
				F_2 Population				
LEN	0.75	0.69	-0.03	-0.51	0.56	0.20	0.32	0.39
UR		0.53	0.24	-0.26	0.49	0.14	0.14	0.21
STR			0.12	-0.36	0.39	0.48	0.18	0.23
ELO				0.43	-0.22	0.13	-0.06	-0.02
MIC					-0.15	-0.23	-0.09	-0.11
LP						0.03	0.09	0.23
BW							0.19	0.19
YLD								0.99
				C_0 Population				
LEN	0.61	0.46	0.00	-0.48	0.17	0.18	0.13	0.15
UR		0.54	0.44	-0.09	0.22	0.12	0.02	0.04
STR			0.39	-0.08	0.09	0.34	0.04	0.06
ELO				0.43	-0.20	0.01	0.13	0.16
MIC					-0.22	0.03	-0.12	-0.10
LP						0.12	0.01	0.12
BW							0.33	0.31
YLD								0.99
				C_1 Population				
LEN	0.62	0.31	0.08	-0.05	0.28	0.20	0.23	0.26
UR		0.32	0.20	0.13	0.34	0.16	0.18	0.22
STR			0.47	0.16	0.21	0.09	0.07	0.10
ELO				0.40	-0.20	0.12	-0.05	-0.03
MIC					-0.37	0.07	-0.02	0.03
LP						0.05	0.08	0.19
BW							0.39	0.37
YLD								0.99
				C_2 Population				
LEN	0.55	0.18	-0.19	-0.05	-0.18	0.05	0.07	0.05
UR		0.50	0.06	0.14	0.10	0.07	0.06	0.07
STR			0.44	0.22	0.23	0.14	0.02	0.05
ELO				0.28	0.27	0.03	0.14	0.17
MIC					0.33	0.14	0.02	0.05
LP						0.10	0.06	0.17
BW							0.18	0.17
YLD								0.99
				C_3 Population				
LEN	0.50	0.26	0.14	-0.14	-0.08	0.14	0.33	0.32
UR		0.28	0.29	0.21	0.02	0.50	0.26	0.26
STR			0.30	0.18	0.08	0.34	0.09	0.10
ELO				0.40	0.27	0.23	0.17	0.20
MIC					0.43	0.31	0.10	0.14
LP						0.29	0.05	0.14
BW							0.37	0.39
YLD								1.00

[1]Correlation coefficient (≥ 0.27 or ≤ -0.27) is significant at 0.05 and correlation coefficient (≥ 0.34 or ≤ -0.34) is significant at 0.01. LEN = fiber length (mm), UR = fiber uniform ratio (%), STR = fiber strength (g/tex), ELO = fiber elongation (%), MIC = micronaire, LP = lint percentage (%), BW = boll weight (g), YLD = seed cotton yield (kg/ha), and LY = lint yield (kg/ha).

Correlations among different cycles of random mating for each trait

Regarding fiber length, F_2 populations were correlated with C_0S_1 populations (0.65) and C_1S_1 population (0.28) (Table 6). C_0S_1 populations and C_1S_1 populations had significant correlation (0.40). There were no significant correlations with C_2S_1 and C_3S_1 populations or within C_2S_1 and C_3S_1 populations. Regarding fiber uniformity ratio, only the F_2 and C_0S_1 populations had significant correlation (0.63). Regarding fiber strength, significant correlations were detected between the F_2 and C_0S_1 (0.65), F_2 and C_1S_1 (0.43), and C_0S_1 and C_1S_1 (0.31). A significant correlation was also detected between C_1S_1 and C_3S_1 (0.28). Regarding fiber elongation, significant correlations were detected between F_2 and C_0S_1 (0.66), F_2 and C_1S_1 (0.38). Regarding micronaire, significant correlations were detected between F_2 and C_0S_1 (0.55), F_2 and C_1S_1 (0.34) (Table 6).

Significant correlations were detected for lint percentage between F_2 and C_0S_1 (0.49), F_2 and C_1S_1 (0.45), and F_2 and C_2S_1 (0.40). Significant correlations were detected for boll weight between F_2 and C_0S_1 (0.44), F_2 and C_1S_1 (0.46), and C_0S_1 and C_1S_1 (0.38). No significant correlations were detected among different cycles of random mating for both seed cotton yield and lint yield (Table 6). In summary, higher correlations between F_2 and C_0S_1 were detected than those among other generations for most traits.

Table 6. Correlation among different generations for fiber and agronomic traits.[1]

	C_0S_1	C_1S_1	C_2S_1	C_3S_1
Fiber Length (mm)				
F_2	0.65	0.28	0.15	0.07
C_0S_1		0.40	0.10	0.03
C_1S_1				0.17
C_2S_1				0.04
Fiber Uniform Ratio (%)				
F_2	0.63	0.19	-0.08	0.15
C_0S_1		0.10	-0.15	0.04
C_1S_1			0.10	-0.21
C_2S_1				0.07
Fiber Strength (g/tex)				
F_2	0.65	0.43	0.16	-0.02
C_0S_1		0.31	0.15	0.09
C_1S_1			0.08	0.28
C_2S_1				-0.02
Fiber Elongation (%)				
F_2	0.66	0.38	-0.09	0.03
C_0S_1		0.25	-0.04	0.11
C_1S_1			-0.16	0.06
C_2S_1				0.17
Micronaire				
F_2	0.55	0.34	-0.18	-0.09
C_0S_1		0.17	-0.10	0.01
C_1S_1			-0.15	-0.03
C_2S_1				0.17

	C_0S_1	C_1S_1	C_2S_1	C_3S_1
Lint Percentage (%)				
F_2	0.49	0.45	0.40	0.11
C_0S_1		0.17	0.10	-0.16
C_1S_1			0.18	0.06
C_2S_1				0.21
Boll Weight (g)				
F_2	0.44	0.46	-0.05	0.13
C_0S_1		0.38	-0.12	0.05
C_1S_1			0.13	-0.10
C_2S_1				0.07
Seed Cotton Yield (kg/ha)				
F_2	0.16	0.18	-0.25	0.10
C_0S_1		0.14	0.13	-0.06
C_1S_1			0.03	0.02
C_2S_1				-0.17
Lint Yield (kg/ha)				
F_2	0.17	0.19	-0.23	0.11
C_0S_1		0.12	0.15	-0.05
C_1S_1			0.04	0.06
C_2S_1				-0.17

[1]Correlation coefficient (≥ 0.27 or ≤ -0.27) is significant at 0.05 and correlation coefficient (≥ 0.34 or ≤ -0.34) is significant at 0.01.

Multiple comparisons among populations for different cycles of random mating

The mean values for 11 parents, five cycles of bulked populations, and 55 populations with different cycles of random mating are summarized in Tables 7 to 11.

F_2 Hybrid Populations

Twenty-eight F_2 hybrids had fiber length greater than 28 mm. Eight out of 55 F_2 hybrids had fiber length greater than 29 mm. Among them, six were from Acala Ultima as parent and two were from C315 (Table 7). All F_2 hybrids except DP90×M240 had fiber uniformity ratio greater than 81%. Nineteen F_2 hybrids had uniformity ratio greater than 82%. Ten out of 55 F_2 hybrids had fiber strength greater than 30 g/tex, and six F_2 hybrids had fiber strength greater than 31 g/tex. One F_2 hybrid (FM966 × Acala Ultima) had fiber strength of 35.88 g/tex, which was higher than the best parent Acala Ultima (33.05 g/tex). Eighteen F_2 hybrids had fiber elongation greater than 8%. Eleven F_2 hybrids had micronaire readings less than 5, and only one hybrid (PSC355 × M240) had a micronaire greater than 5. The remaining F_2 hybrids were not significantly different from

5. More than half of the F_2 hybrids (33) had lint percentage greater than 39%, 18 were greater than 40%, and three were greater than 41%. No F_2 hybrids were less than 39%. Ten F_2 hybrids had boll weights greater than 5 g, while seven F_2 hybrids were less than 5 g. Five F_2 hybrids produced more than 2,000 kg/ha of seed cotton, and the remaining F_2 hybrids did not differ from 2,000 kg/ha. Six F_2 hybrids produced more than 800 kg/ha of lint, and one F_2 hybrid (DP90 × HS26) produced more than 900 kg/ha (Table 7).

C_0S_1 Population (after one cycle of random mating)

Twenty-six populations were greater than 28 mm for 2.5% fiber span length, and only one population (ST474 × Acala Ultima) was greater than 29 mm. All populations except HS26 × M240 were greater than 80% for fiber uniformity ratio, 43 were greater than 81%, and nine were greater than 82% (Table 8). Three populations were greater than 30 g/tex for fiber strength, and one population was greater than 31 g/tex. Fourteen populations were greater than 8% for fiber elongation. Seven populations had a micronaire value less than 5, and the remaining populations were not different from 5. Thirty populations were greater than 39% for lint percentage, and five populations were greater than 40%. All populations had boll weights greater than 4 g, and two populations were greater than 5 g. No population had a boll weight greater than 5.5 g. Five populations had seed cotton yields greater than 2,000 kg/ha, and all other populations did not differ from 2,000 kg/ha. Five populations were greater than 800 kg/ha for lint yield, and one population was greater than 1,000 kg/ha. Three populations were less than 1,000 kg/ha for lint yield, and one population was less than 900 kg/ha.

C_1S_1 Population (after two cycles of random mating)

After two cycles of random mating, 36 populations were greater than 28 mm for fiber length, and the remaining populations were not different from 28 mm (Table 9). All populations were greater than 80% for fiber uniformity ratio, 47 populations were greater than 81%, and seven populations were greater than 82%. Thirty populations were greater than 28 g/tex for fiber strength, seven populations were greater than 29 g/tex, and one population (PSC355 × FM966) was greater than 30 g/tex. Twelve populations were greater than 8% for fiber elongation. Five populations were less than 5 for fiber micronaire, and one population was greater than 5. The remaining populations were not different from 5 for micronaire. Fifty-three populations were greater than 38% for lint percentage, seven populations were greater than 39%, and three populations were greater than 40%. Five populations were greater than 5 g for boll weight, and four were less than 5 g. Four populations were greater than 2,000 kg/ha for seed cotton yield; most of the remaining populations were numerically greater than 2,000 kg/ha, but this difference was not significant. Four populations were greater than 800 kg/ha for lint yield.

C_2S_1 Population (after three cycles of random mating)

After three cycles of random mating, 28 populations were greater than 28 mm for fiber length, and no population was greater than 29 mm (Table 10). All populations were greater than 80% for fiber uniformity ratio, 48 populations were greater than 81%, and nine populations were greater than 82%. Twenty-seven populations were greater than 28 g/tex for fiber strength, seven populations were greater than 29 g/tex, and two populations (ST474 × ST825 and ST474 × FM966) were greater than 30 g/tex. Fourteen populations were greater than 8% for fiber elongation. One population (HS26 × ST825, 4.6) was less than 5 for fiber micronaire, and no population was greater than 5. Fifty-three populations were greater than 38% for lint percentage, 38 populations were greater than 39%, and seven populations were greater than 40%. Four populations were greater than 5 g for boll weight, and three populations were less than 5 g. One population (ST474 × C315) produced 2,826 kg/ha of seed cotton yield. Four populations produced more than 700 kg/ha of lint.

C_3S_1 Population (after four cycles of random mating)

After four cycles of random mating, 29 populations were greater than 28 mm for fiber length, and no population was greater than 29mm (Table 11). Fifty-four populations were greater than 80% for fiber uniformity ratio, 50 populations were greater than 81%, and eight populations were greater than 82%. Thirty-one populations were greater than 28 g/tex for fiber strength, six populations were greater than 29 g/tex, and no population was greater than 30 g/tex. Fifteen populations were greater than 8% for fiber elongation. Three populations (M240 × Pyramid, 4.63; DP90 × C315, 4.55; and ST474 × DP90, 4.6, respectively) were less than 5 for fiber micronaire, and no population was greater than 5. Fifty-one populations were greater than 38% for lint percentage, 25 populations were greater than 39%, and four populations were greater than 40%. Two populations were greater than 5 g for boll weight, and only one population (SG747 × C315, 4.5 g) was less than 5 g. One population (ST825 × C315, 2,844 kg/ha) was greater than 2,000 kg/ha for seed cotton yield. Ten populations were greater than 700 kg/ha for lint, and one population was greater 800 kg/ha.

Table 7. Mean comparisons among parents, five bulk populations, and 55 F_2 populations.[1]										
Generation	Entry	LEN	UR	STR	ELO	MIC	LP	BW	YLD	LY
Parent	Acala Ultima	31.12	84.63	33.05	7.90	4.08	39.92	5.62	1482	592
	Pyramid	27.62	82.75	28.45	8.58	5.35	39.90	4.94	1484	592
	Coker 315	29.15	82.95	28.60	7.90	4.68	41.21	4.73	2085	859
	ST 825	28.45	82.38	27.00	7.68	4.90	40.14	4.23	1895	761
	FM 966	29.91	84.50	34.50	7.95	4.85	43.29	5.18	1961	849
	M 240	26.29	81.95	29.95	9.03	5.25	38.03	4.94	2083	792
	PM HS26	27.37	82.55	29.35	8.85	4.85	37.68	5.19	1900	716
	DP 90	28.51	82.28	29.58	8.50	5.10	40.66	4.39	2775	1128
	SG 747	28.70	83.60	27.63	8.85	5.10	42.32	4.66	1626	688
	PSC 355	28.61	83.36	30.76	9.28	5.14	41.18	4.62	2368	976
	ST 474	27.81	82.50	28.95	8.55	5.40	43.09	4.51	2398	1033
Bulk	F_2 bulk	28.83	82.63	29.98	8.15	4.75	41.07	4.74	1609	661
	C_0S_1 bulk	29.02	82.93	30.58	8.40	5.08	40.73	5.14	2431	990
	C_1 S_1 bulk	28.45	82.45	30.98	8.20	4.75	40.20	5.07	1573	632
	C_2 S_1 bulk	28.64	82.13	29.98	8.35	4.80	39.82	5.11	1934	770
	C_3 S_1 bulk	28.83	82.43	30.35	8.35	5.05	39.70	4.75	2234	887
F_2	Pyramid x Acala	29.21	82.93	31.63	8.20	4.55	41.76	5.99	1815	758
	C315 x Acala U	30.23	83.73	34.08	8.35	4.50	40.90	5.63	2196	898
	ST825 x Acala U	30.42	84.30	32.58	8.35	4.55	41.21	5.28	1956	806
	FM966 x Acala U	30.61	84.08	35.88	8.25	4.45	42.12	5.29	2174	916
	M240 x Acala U	29.21	82.65	33.90	8.40	4.70	40.01	5.54	2293	917
	HS26 x Acala U	29.59	83.75	32.30	8.40	4.60	40.18	5.76	2278	915
	DP90 x Acala U	30.10	82.50	33.60	8.10	4.53	41.53	5.16	2286	949
	SG747 x Acala U	30.04	83.65	31.88	8.50	4.50	42.06	5.52	2845	1196
	PSC355 x Acala U	29.53	83.68	31.78	8.95	4.73	42.09	4.78	2532	1066
	ST474 x Acala U	30.48	83.93	33.98	8.43	4.68	42.56	4.93	1647	701
	C315 x Pyramid	29.21	83.05	28.50	7.98	4.58	39.66	5.14	1591	631
	ST825 x Pyramid	28.19	82.50	27.68	7.90	4.83	39.81	4.78	1900	756
	FM966 x Pyramid	29.08	82.83	31.48	8.00	4.50	39.53	5.14	2641	1044
	M240 x Pyramid	27.50	82.45	28.45	8.15	5.13	39.05	5.02	1340	523
	HS26 x Pyramid	27.43	82.05	30.33	8.63	4.90	38.92	5.34	1615	629
	DP90 x Pyramid	28.19	81.63	29.38	8.10	4.90	40.46	4.80	1687	683
	SG747 x Pyramid	28.96	83.43	28.93	8.40	4.68	39.17	4.32	1941	760
	PSC355 x Pyramid	28.32	82.60	29.90	8.73	5.00	40.46	4.91	2370	959
	ST474 x Pyramid	28.32	82.55	28.78	8.30	4.98	41.66	5.07	1994	830
	ST825 x C315	28.89	82.88	28.78	7.90	4.65	39.96	4.94	2936	1173
	FM966 x C315	30.04	83.45	32.98	8.10	4.83	41.18	5.67	2938	1210
	M240 x C315	28.19	82.03	30.28	8.15	4.73	39.37	5.65	1951	768
	HS26 x C315	28.89	82.13	29.73	8.25	4.95	39.27	5.33	2450	962
	DP90 x C315	29.91	83.35	29.90	7.98	4.68	39.73	4.89	2810	1116
	SG747 x C315	29.15	82.50	29.98	8.30	4.65	41.58	5.01	2496	1038
	PSC355 x C315	29.34	83.98	29.20	8.68	4.83	40.49	5.06	2837	1149
	ST474 x C315	28.83	82.25	27.80	7.90	4.55	39.82	5.05	2356	938
	FM966 x ST825	29.78	82.63	30.50	7.95	5.05	40.62	5.32	2671	1085
	M240 x ST825	28.26	82.38	28.75	7.90	5.03	39.15	5.43	2311	905
	HS26 x ST825	28.70	81.93	30.30	8.35	4.93	39.90	4.67	1956	780
	DP90 x ST825	28.51	81.85	28.25	7.68	4.88	41.46	4.60	2363	980
	SG747 x ST825	29.08	82.78	28.33	8.33	4.90	40.89	5.04	2243	917
	PSC355 x ST825	29.15	83.45	29.55	8.50	5.05	39.91	4.39	2133	851
	ST474 x ST825	28.13	82.33	27.78	8.05	5.03	40.85	4.77	1939	792
	M240 x FM966	28.07	82.45	31.20	8.08	4.88	39.46	5.24	2415	953
	HS26 x FM966	28.70	82.38	32.73	8.35	4.80	40.00	5.87	2762	1105
	DP90 x FM966	29.34	83.30	30.50	7.90	4.48	40.55	4.56	1804	731
	SG747 x FM966	29.21	83.28	30.00	8.40	4.95	42.12	5.16	2345	988
	PSC355 x FM966	29.46	83.60	33.55	8.60	5.23	41.80	5.14	2035	851
	ST474 x FM966	29.85	83.65	31.88	8.25	4.88	42.20	5.22	2724	1149
	HS26 x M240	27.37	81.15	27.53	8.35	5.18	38.23	5.02	2182	834
	DP90 x M240	27.88	81.08	28.60	8.05	4.65	40.40	4.70	2115	854
	SG747 x M240	28.26	82.78	30.93	8.65	5.10	41.01	5.70	2416	991
	PSC355 x M240	28.64	82.38	30.73	8.90	5.45	39.91	4.97	2040	814
	ST474 x M240	28.00	82.00	28.75	8.35	4.88	39.60	5.14	1990	788
	DP90 x HS26	28.89	81.88	30.45	8.25	4.85	39.86	4.73	3252	1296
	SG747 x HS26	28.58	83.25	29.48	8.70	5.00	39.79	5.00	1754	698
	PSC355 x HS26	28.07	82.50	30.33	8.83	5.05	39.28	4.88	2260	888
	ST474 x HS26	28.45	82.20	28.93	8.70	4.88	40.38	5.20	2247	907
	SG747 x DP90	28.89	81.88	29.03	8.68	4.73	41.16	4.42	1785	735
	PSC355 x DP90	29.15	82.70	30.38	8.68	5.08	40.58	4.28	2349	953
	ST474 x DP90	28.38	82.58	30.28	8.20	4.78	41.22	4.42	1958	807
	PSC355 x SG747	28.64	82.93	28.53	8.98	5.10	41.78	4.49	2059	860
	ST474 x SG747	28.51	83.15	28.48	8.85	5.13	42.61	4.61	2081	887
	ST474 x PSC355	29.08	84.05	30.70	8.75	5.03	41.49	4.83	2523	1047
	LSD 0.05	0.91	1.13	2.26	0.42	0.35	1.25	0.40	831	340

[1]LEN = fiber length (mm), UR = fiber uniform ratio (%), STR = fiber strength (g/tex), ELO = fiber elongation (%), MIC = micronaire, LP = lint percentage (%), BW = boll weight (g), YLD = seed cotton yield (kg/ha), and LY = lint yield (kg/ha).

Table 8. Mean comparisons among parents, five bulk populations, and 55 C_0S_1 populations.

Generation	Entry	LEN	UR	STR	ELO	MIC	LP	BW	YLD	LY
Parent	Acala Ultima	30.48	84.73	34.33	7.98	4.28	40.96	5.87	1748	716
	Pyramid	27.56	82.70	28.63	8.55	5.35	40.34	4.96	1290	520
	Coker 315	29.34	83.23	28.40	7.95	4.58	38.99	4.59	2614	1019
	ST 825	29.02	82.83	28.28	7.80	5.00	39.86	4.35	2419	964
	FM 966	28.77	83.28	32.65	7.95	4.73	41.37	5.39	3201	1324
	M 240	26.54	81.68	29.73	9.13	4.83	38.26	4.15	742	284
	PM HS26	27.81	83.13	31.93	9.10	5.33	36.59	5.48	2159	790
	DP 90	29.15	82.48	30.43	8.30	4.93	39.95	4.72	2915	1165
	SG 747	28.58	83.18	27.28	9.08	5.05	42.32	5.21	3360	1422
	PSC 355	28.89	83.35	29.99	9.18	5.04	40.49	4.05	2349	950
	ST 474	28.13	82.40	29.58	8.68	5.25	43.44	4.85	2649	1151
Bulk	F_2 bulk	28.77	83.13	30.78	8.50	4.80	41.35	4.93	2276	941
	C_0S_1 bulk	29.59	83.48	32.33	8.30	4.95	40.87	5.05	1994	815
	C_1 S_1 bulk	29.21	83.25	31.13	8.25	5.10	40.02	5.39	1992	797
	C_2 S_1 bulk	29.27	82.65	29.15	8.25	4.95	40.43	5.09	2411	975
	C_3 S_1 bulk	28.77	82.30	30.28	8.35	4.98	40.90	4.83	2435	996
C_0S_1	Pyramid x Acala	28.96	82.15	30.75	8.30	4.70	39.16	5.10	2336	915
	C315 x Acala U	29.40	83.33	31.40	8.20	4.50	40.47	5.13	1905	771
	ST825 x Acala U	29.21	82.90	31.70	8.30	4.73	41.02	5.22	2449	1005
	FM966 x Acala U	29.40	82.88	33.70	8.50	4.88	41.93	5.53	2672	1120
	M240 x Acala U	28.96	82.68	31.65	8.35	4.83	39.50	5.23	2018	797
	HS26 x Acala U	29.02	82.98	31.33	8.35	4.70	41.13	5.41	2371	975
	DP90 x Acala U	29.46	82.93	32.00	8.35	4.80	40.07	5.18	1972	790
	SG747 x Acala U	29.40	83.73	31.10	8.30	4.78	41.20	5.42	2308	951
	PSC355 x Acala U	29.27	83.43	31.45	8.63	4.50	41.03	4.79	2912	1195
	ST474 x Acala U	30.42	83.58	31.00	8.30	4.58	40.72	5.25	2452	999
	C315 x Pyramid	28.83	83.15	30.45	8.30	4.85	39.94	5.11	2599	1038
	ST825 x Pyramid	28.26	82.70	30.63	8.35	4.93	40.73	4.96	1334	543
	FM966 x Pyramid	29.21	82.70	31.23	7.95	4.60	39.68	5.17	2078	825
	M240 x Pyramid	28.13	82.50	30.13	8.45	5.10	39.53	4.96	2272	898
	HS26 x Pyramid	28.45	81.95	29.68	8.10	4.75	40.18	5.13	2010	808
	DP90 x Pyramid	28.89	82.18	28.13	8.05	4.88	40.12	5.29	1959	786
	SG747 x Pyramid	29.46	83.08	28.43	8.23	4.60	39.35	5.51	1917	754
	PSC355 x Pyramid	29.15	83.43	32.75	8.73	5.00	39.71	5.34	2709	1076
	ST474 x Pyramid	28.83	82.65	29.90	8.30	5.00	40.72	4.62	2112	860
	ST825 x C315	28.77	82.23	29.55	8.25	4.88	39.39	5.15	2356	928
	FM966 x C315	29.72	82.35	31.35	8.20	4.80	40.16	5.14	1945	781
	M240 x C315	28.58	82.70	30.28	8.20	4.95	39.24	5.34	2396	940
	HS26 x C315	28.07	81.60	28.35	8.15	4.83	38.71	5.36	2744	1062
	DP90 x C315	29.53	82.68	29.98	7.78	4.45	39.42	5.07	2875	1133
	SG747 x C315	28.83	82.30	29.05	8.35	4.65	39.80	4.93	2893	1151
	PSC355 x C315	28.19	82.73	29.00	8.35	5.00	41.22	4.72	2044	842
	ST474 x C315	29.21	82.43	29.10	8.15	4.65	40.58	4.50	1492	605
	FM966 x ST825	28.45	81.58	28.15	8.05	4.75	41.48	4.95	2065	857
	M240 x ST825	28.64	82.45	29.15	8.20	5.08	40.91	5.12	2728	1116
	HS26 x ST825	27.69	82.53	28.13	8.20	5.05	40.01	4.96	2138	855
	DP90 x ST825	29.08	81.73	29.48	8.00	4.60	40.31	5.07	2724	1098
	SG747 x ST825	29.27	81.93	27.90	8.10	4.78	40.62	4.97	2352	956
	PSC355 x ST825	29.27	83.10	30.63	8.40	4.68	39.03	4.72	2209	862
	ST474 x ST825	28.58	82.38	29.55	8.25	4.80	40.15	4.60	1589	638
	M240 x FM966	28.58	81.95	30.20	8.15	4.95	40.43	5.44	1805	730
	HS26 x FM966	28.83	82.73	31.53	8.50	4.75	39.55	5.37	2888	1142
	DP90 x FM966	29.65	83.28	32.08	8.30	4.90	40.33	4.99	2002	807
	SG747 x FM966	29.08	83.35	31.38	8.58	5.05	41.54	5.19	1921	798
	PSC355 x FM966	29.46	83.43	30.83	8.37	4.83	41.55	5.42	2282	948
	ST474 x FM966	28.83	83.00	30.25	8.15	4.88	40.54	4.61	1823	739
	HS26 x M240	27.50	81.20	30.05	8.35	4.90	39.17	5.22	2080	815
	DP90 x M240	28.70	82.20	29.78	8.30	4.68	39.63	4.43	1307	518
	SG747 x M240	28.51	82.75	30.43	8.55	5.23	40.11	5.32	2286	917
	PSC355 x M240	28.83	82.73	31.20	8.68	5.33	40.77	5.13	1989	811
	ST474 x M240	27.69	82.05	29.10	8.30	5.08	40.92	4.72	1524	623
	DP90 x HS26	28.58	82.33	30.05	8.25	5.00	39.09	5.12	2232	873
	SG747 x HS26	28.64	83.00	30.25	8.50	4.73	39.56	4.74	1932	764
	PSC355 x HS26	29.40	83.65	29.48	8.63	4.98	40.66	4.88	2110	858
	ST474 x HS26	28.58	82.53	30.40	8.40	4.80	40.85	4.95	2624	1072
	SG747 x DP90	28.77	82.58	29.65	8.30	5.08	41.89	4.88	1889	791
	PSC355 x DP90	28.96	82.28	29.95	8.55	5.00	41.89	4.77	3253	1363
	ST474 x DP90	28.77	82.15	28.68	8.25	4.98	40.68	4.83	2707	1101
	PSC355 x SG747	28.77	82.78	28.48	8.55	4.88	40.17	4.82	2326	934
	ST474 x SG747	28.51	82.35	28.18	8.35	4.98	41.17	4.61	2467	1016
	ST474 x PSC355	29.40	82.95	31.50	8.30	4.90	40.43	4.50	1409	570
	LSD 0.05	0.91	1.22	2.07	0.39	0.38	1.24	0.44	783	316

[1]LEN = fiber length (mm), UR = fiber uniform ratio (%), STR = fiber strength (g/tex), ELO = fiber elongation (%), MIC = micronaire, LP = lint percentage (%), BW = boll weight (g), YLD = seed cotton yield (kg/ha), and LY = lint yield (kg/ha).

Table 9. Mean comparisons among parents, five bulk populations, and 55 C_1S_1 populations.[1]

Generation	Entry	LEN	UR	STR	ELO	MIC	LP	BW	YLD	LY
Parent	Acala Ultima	29.59	83.45	31.30	8.05	4.18	40.88	5.41	1616	661
	Pyramid	27.50	82.18	27.80	8.55	5.33	40.25	4.97	1485	598
	Coker 315	29.02	82.28	29.13	7.90	4.55	41.48	4.57	2024	839
	ST 825	28.51	83.13	28.93	8.15	5.08	40.68	4.39	1926	784
	FM 966	29.15	82.88	31.93	8.00	4.90	42.06	5.72	2914	1225
	M 240	26.54	81.50	29.28	9.05	4.98	37.58	5.17	2752	1034
	PM HS26	27.69	82.18	31.18	9.18	5.25	36.94	5.35	1662	614
	DP 90	29.02	82.68	31.13	8.63	5.05	40.08	4.45	2303	923
	SG 747	28.13	82.65	26.98	8.78	4.80	42.28	4.76	2471	1045
	PSC 355	28.67	83.29	31.40	9.54	5.26	40.79	4.29	2006	820
	ST 474	28.13	82.53	27.70	8.30	5.08	43.30	4.36	2314	1002
Bulk	F_2 bulk	29.15	82.50	29.85	8.15	5.00	40.82	5.12	2102	858
	C_0S_1 bulk	29.08	82.98	30.53	8.45	4.98	40.55	5.17	2501	1014
	C_1 S_1 bulk	28.77	82.50	30.38	8.40	4.78	41.16	5.11	2275	936
	C_2 S_1 bulk	29.08	82.20	29.30	8.50	4.95	41.39	5.12	2527	1046
	C_3 S_1 bulk	28.89	82.38	28.95	8.25	4.93	40.39	4.96	1761	711
C_1S_1	Pyramid x Acala	29.15	83.03	30.33	8.25	4.90	41.55	5.45	2410	1001
	C315 x Acala U	29.65	82.98	31.13	8.35	4.80	40.11	5.47	2169	870
	ST825 x Acala U	28.38	82.25	30.13	8.35	4.75	40.04	5.18	2424	971
	FM966 x Acala U	29.59	83.43	30.93	8.15	4.58	41.80	5.03	2700	1129
	M240 x Acala U	28.77	82.03	29.73	8.00	4.65	39.99	5.24	2166	866
	HS26 x Acala U	29.02	83.23	30.78	8.45	4.75	40.70	5.37	2257	919
	DP90 x Acala U	29.02	83.08	30.45	8.45	5.08	42.35	5.25	2510	1063
	SG747 x Acala U	29.15	82.95	31.53	8.40	4.88	39.96	4.75	1853	740
	PSC355 x Acala U	29.27	82.70	30.88	8.45	4.83	39.89	4.95	2282	910
	ST474 x Acala U	28.89	82.70	31.70	8.30	4.75	40.97	5.20	1950	799
	C315 x Pyramid	28.70	82.10	29.98	8.50	4.83	39.75	5.26	2131	847
	ST825 x Pyramid	27.69	82.38	29.65	8.35	5.00	39.58	4.81	1660	657
	FM966 x Pyramid	28.89	82.38	30.95	8.45	4.98	40.27	4.88	1853	746
	M240 x Pyramid	29.02	82.23	30.33	8.35	4.80	39.74	5.44	1915	761
	HS26 x Pyramid	28.70	82.45	31.63	8.40	5.08	40.23	5.23	1903	766
	DP90 x Pyramid	28.00	81.85	30.25	8.20	4.83	39.32	4.33	1624	639
	SG747 x Pyramid	29.02	83.13	30.98	8.30	4.90	40.31	5.41	2089	842
	PSC355 x Pyramid	28.83	82.48	29.95	8.48	4.88	40.16	4.79	2436	978
	ST474 x Pyramid	28.77	82.75	30.53	8.20	4.93	40.73	4.91	2141	872
	ST825 x C315	29.21	83.03	28.00	8.00	4.90	40.08	5.30	2186	876
	FM966 x C315	28.89	83.33	30.65	8.20	4.90	40.24	5.18	2949	1186
	M240 x C315	28.58	82.43	29.35	8.05	4.88	39.42	5.37	2990	1179
	HS26 x C315	28.38	81.98	28.28	8.05	4.93	39.79	5.25	2219	883
	DP90 x C315	28.89	82.43	29.25	8.20	5.05	40.64	5.43	2264	920
	SG747 x C315	28.96	83.00	30.48	8.40	4.65	39.13	4.90	2108	825
	PSC355 x C315	28.51	82.15	29.80	8.10	4.88	40.92	4.71	1716	702
	ST474 x C315	29.46	83.50	30.28	8.35	4.88	40.00	5.17	2774	1110
	FM966 x ST825	28.45	82.45	29.83	8.40	4.78	40.05	5.25	2128	852
	M240 x ST825	29.15	82.35	29.25	7.85	4.53	39.50	5.17	1722	680
	HS26 x ST825	28.77	82.90	28.95	8.10	5.20	40.84	5.03	2326	950
	DP90 x ST825	29.34	82.88	30.90	8.30	5.08	40.47	5.22	2559	1036
	SG747 x ST825	29.15	83.53	31.13	8.15	4.78	40.15	4.91	1886	757
	PSC355 x ST825	28.89	83.03	29.35	8.30	5.05	40.55	4.57	2670	1083
	ST474 x ST825	28.51	82.00	29.33	8.40	5.03	40.54	4.65	1286	521
	M240 x FM966	29.21	83.43	30.45	8.63	5.18	41.05	5.40	2282	937
	HS26 x FM966	28.58	82.03	30.98	8.20	4.88	39.69	5.26	2879	1143
	DP90 x FM966	28.83	81.55	29.85	8.15	4.68	40.64	4.81	2934	1192
	SG747 x FM966	29.53	83.30	29.83	8.10	4.88	41.19	5.45	2320	955
	PSC355 x FM966	29.53	82.93	32.85	8.58	5.03	41.08	5.31	2948	1211
	ST474 x FM966	29.15	83.15	31.23	8.30	4.90	40.79	4.95	2661	1085
	HS26 x M240	28.45	82.50	30.18	8.25	4.88	40.11	5.09	2599	1042
	DP90 x M240	29.34	82.83	30.63	8.20	4.73	39.62	4.94	2017	799
	SG747 x M240	29.04	82.53	29.43	8.37	4.80	40.77	4.83	2291	934
	PSC355 x M240	28.64	82.38	31.25	8.65	5.35	40.05	5.20	2339	937
	ST474 x M240	28.38	82.33	28.80	8.05	4.85	38.50	5.10	2192	844
	DP90 x HS26	29.40	82.83	30.80	8.10	4.95	39.31	5.24	2430	955
	SG747 x HS26	29.08	82.38	28.28	8.25	4.68	40.06	5.03	2161	866
	PSC355 x HS26	29.02	83.20	29.38	8.35	4.88	40.43	4.74	1780	720
	ST474 x HS26	28.77	82.68	29.25	8.40	4.43	37.83	5.41	2772	1049
	SG747 x DP90	29.65	82.83	30.25	8.53	5.05	40.55	4.43	2024	821
	PSC355 x DP90	29.72	82.95	30.83	8.40	4.93	39.79	4.85	1967	783
	ST474 x DP90	29.15	82.25	28.20	8.00	4.78	40.09	5.09	2696	1081
	PSC355 x SG747	28.96	82.95	30.18	8.58	5.08	40.84	4.90	2245	917
	ST474 x SG747	28.58	82.70	29.50	8.45	4.93	41.49	4.44	1944	806
	ST474 x PSC355	29.08	82.83	29.93	8.38	5.05	40.56	5.12	2654	1077
	LSD 0.05	0.82	1.17	1.99	0.41	0.34	1.28	0.42	791	319

[1]LEN = fiber length (mm), UR = fiber uniform ratio (%), STR = fiber strength (g/tex), ELO = fiber elongation (%), MIC = micronaire, LP = lint percentage (%), BW = boll weight (g), YLD = seed cotton yield (kg/ha), and LY = lint yield (kg/ha).

Table 10. Mean comparisons among parents, five bulk populations, and 55 C_2S_1 populations.[1]

Generation	Entry	LEN	UR	STR	ELO	MIC	LP	BW	YLD	LY
Parent	Acala Ultima	30.80	84.45	33.75	7.83	4.15	40.39	5.58	1391	562
	Pyramid	27.31	81.50	28.03	8.55	4.93	39.87	4.87	1454	580
	Coker 315	29.27	82.90	28.98	8.00	4.68	41.10	5.00	2099	863
	ST 825	28.77	83.58	29.53	8.10	5.25	40.30	4.98	2537	1023
	FM 966	29.21	83.13	33.30	7.98	4.93	41.51	5.40	2237	928
	M 240	26.92	81.80	29.85	8.80	4.83	36.42	4.98	2005	730
	PM HS26	27.81	82.43	30.43	8.90	4.75	36.65	5.15	1745	639
	DP 90	29.08	83.58	31.20	8.73	5.00	40.01	4.65	1971	789
	SG 747	28.70	82.45	27.18	8.88	4.98	41.93	4.78	2297	963
	PSC 355	28.73	83.29	30.63	9.56	5.26	41.41	4.33	2171	899
	ST 474	28.07	82.45	27.98	8.35	5.18	43.01	4.56	2437	1048
Bulk	F_2 bulk	29.02	83.28	30.53	8.45	4.85	41.19	4.41	1986	818
	C_0S_1 bulk	28.38	82.68	30.00	8.30	4.63	40.23	4.97	2352	946
	C_1 S_1 bulk	29.08	82.60	29.98	8.20	4.73	40.49	4.94	1899	769
	C_2 S_1 bulk	28.96	83.33	30.95	8.35	4.75	41.02	4.90	1959	804
	C_3 S_1 bulk	28.89	82.35	28.90	8.00	4.95	40.63	4.82	2028	824
C_2S_1	Pyramid x Acala	29.08	82.98	30.05	8.25	4.85	40.87	5.20	2078	849
	C315 x Acala U	29.02	82.43	29.05	8.40	4.88	40.55	5.32	1849	750
	ST825 x Acala U	29.53	82.65	30.80	8.10	4.85	40.13	4.62	2344	941
	FM966 x Acala U	28.58	82.60	30.33	8.45	4.75	40.07	5.32	2492	999
	M240 x Acala U	28.83	82.38	31.33	8.45	4.88	40.32	5.55	1720	694
	HS26 x Acala U	29.08	82.50	30.50	8.35	4.85	40.62	4.81	2055	835
	DP90 x Acala U	28.77	83.38	31.30	8.25	5.03	41.87	5.01	1852	776
	SG747 x Acala U	29.08	83.18	30.88	8.45	4.83	41.20	4.31	2240	923
	PSC355 x Acala U	28.77	82.50	30.08	8.30	4.83	41.18	4.90	2665	1098
	ST474 x Acala U	28.83	82.18	30.15	8.20	5.00	40.87	5.10	2183	892
	C315 x Pyramid	29.08	83.30	29.45	8.25	4.73	40.18	5.41	2428	976
	ST825 x Pyramid	28.38	82.05	28.85	8.20	4.90	40.23	5.04	1971	793
	FM966 x Pyramid	28.70	82.90	30.90	8.30	5.10	40.56	4.96	1976	801
	M240 x Pyramid	29.08	82.00	30.70	8.20	4.65	40.18	4.98	1994	801
	HS26 x Pyramid	29.15	82.83	29.25	8.25	4.70	38.87	5.03	2523	981
	DP90 x Pyramid	28.38	82.10	29.15	8.38	4.98	39.09	4.88	1984	775
	SG747 x Pyramid	28.38	82.15	28.80	8.30	4.98	41.30	5.21	2296	948
	PSC355 x Pyramid	28.70	81.88	30.65	8.40	4.90	39.18	5.29	2343	918
	ST474 x Pyramid	28.38	82.30	30.20	8.48	4.95	40.86	5.07	2723	1113
	ST825 x C315	29.40	82.73	30.70	8.20	5.10	40.30	5.63	2230	899
	FM966 x C315	28.70	82.93	29.98	8.30	4.80	40.65	4.94	1613	656
	M240 x C315	29.08	82.83	30.35	8.68	5.23	40.95	5.34	2563	1050
	HS26 x C315	28.13	82.28	29.80	8.30	4.95	40.53	5.22	2509	1017
	DP90 x C315	29.59	83.45	30.38	8.10	4.78	40.15	5.01	1904	765
	SG747 x C315	29.27	82.88	30.28	8.55	5.15	41.00	4.65	2387	979
	PSC355 x C315	29.08	82.38	28.50	8.10	4.88	39.98	4.88	2263	905
	ST474 x C315	29.27	83.05	29.65	8.35	4.90	40.47	5.24	2826	1144
	FM966 x ST825	29.08	83.90	30.98	8.20	5.08	40.71	5.14	2180	888
	M240 x ST825	28.38	82.30	30.53	8.30	4.85	40.26	4.96	2342	943
	HS26 x ST825	28.51	82.38	29.25	8.30	4.60	40.50	5.35	2654	1075
	DP90 x ST825	29.34	82.45	29.68	8.35	4.95	40.21	4.93	2102	845
	SG747 x ST825	28.83	82.93	30.55	8.25	5.05	39.30	5.27	1678	659
	PSC355 x ST825	29.27	82.80	30.08	8.30	5.03	39.81	5.35	2669	1062
	ST474 x ST825	28.83	83.03	32.03	8.50	4.83	39.85	5.25	2169	864
	M240 x FM966	28.89	82.70	29.60	8.05	4.78	40.38	4.92	2202	889
	HS26 x FM966	28.70	82.65	29.35	8.48	4.90	40.44	4.62	1527	618
	DP90 x FM966	29.15	82.83	29.28	8.35	5.13	40.07	5.21	2402	962
	SG747 x FM966	29.72	82.68	28.33	8.08	4.75	39.89	4.78	1842	735
	PSC355 x FM966	29.27	83.08	30.98	8.43	4.88	40.43	4.92	2389	966
	ST474 x FM966	28.58	82.95	32.10	8.45	4.95	41.57	5.01	2404	999
	HS26 x M240	29.34	82.73	29.43	8.25	4.58	39.15	5.02	1911	748
	DP90 x M240	29.40	83.60	31.53	8.45	4.85	40.49	5.35	2017	817
	SG747 x M240	28.32	82.28	29.75	8.35	5.18	41.52	5.05	1756	729
	PSC355 x M240	28.89	83.23	29.80	8.10	5.05	39.82	4.91	2333	929
	ST474 x M240	28.89	83.10	31.48	8.50	4.85	40.64	5.14	2278	926
	DP90 x HS26	28.26	81.90	28.50	8.25	4.70	39.90	4.72	2064	824
	SG747 x HS26	29.21	82.38	28.75	8.10	5.03	40.76	5.53	2490	1015
	PSC355 x HS26	28.38	82.25	28.45	8.20	4.70	39.93	4.98	2455	980
	ST474 x HS26	29.27	82.93	31.33	8.45	4.85	40.35	5.10	2232	901
	SG747 x DP90	28.77	82.75	30.18	8.55	4.90	40.91	4.66	2540	1039
	PSC355 x DP90	29.53	82.85	29.13	8.20	4.70	40.57	5.02	2567	1041
	ST474 x DP90	28.38	81.93	29.65	8.50	5.08	41.43	4.89	2187	906
	PSC355 x SG747	28.64	81.75	29.38	8.25	4.65	40.70	5.02	2019	822
	ST474 x SG747	28.45	82.35	28.50	8.25	4.73	40.74	4.98	1976	805
	ST474 x PSC355	28.51	81.98	28.48	8.20	4.93	40.05	4.77	1747	700
	LSD 0.05	0.84	1.07	2.02	0.40	0.36	1.16	0.38	911	370

[1]LEN = fiber length (mm), UR = fiber uniform ratio (%), STR = fiber strength (g/tex), ELO = fiber elongation (%), MIC = micronaire, LP = lint percentage (%), BW = boll weight (g), YLD = seed cotton yield (kg/ha), and LY = lint yield (kg/ha).

Table 11. Mean comparisons among parents, five bulk populations, and 55 C_3S_1 populations.[1]

Generation	Entry	LEN	UR	STR	ELO	MIC	LP	BW	YLD	LY
Parent	Acala Ultima	30.23	83.80	32.88	7.95	4.00	40.39	5.50	1373	555
	Pyramid	27.88	82.58	28.75	8.35	5.08	40.40	4.94	1250	505
	Coker 315	29.34	83.38	29.15	8.15	4.70	42.69	4.89	2250	961
	ST 825	28.70	82.53	28.35	7.70	4.98	40.07	4.72	2354	943
	FM 966	29.91	83.55	33.93	7.63	4.70	41.78	4.98	1673	699
	M 240	26.35	81.25	29.50	9.08	5.03	37.86	5.04	2268	859
	PM HS26	27.50	82.53	31.23	9.08	5.05	37.21	5.41	2221	826
	DP 90	29.40	83.38	31.13	8.40	4.90	40.50	4.34	2000	810
	SG 747	28.45	83.13	26.63	8.90	4.88	40.97	4.49	1971	808
	PSC 355	28.80	83.23	30.03	9.51	5.29	39.92	4.47	2729	1087
	ST 474	28.07	82.70	29.03	8.70	5.30	43.95	4.66	2492	1095
Bulk	F_2 bulk	29.08	82.45	30.10	8.35	5.03	40.80	5.01	2181	890
	C_0S_1 bulk	29.34	83.28	29.15	8.05	4.73	39.01	4.96	2561	999
	C_1S_1 bulk	29.08	82.40	29.65	8.35	5.08	39.75	5.36	2812	1118
	C_2S_1 bulk	29.08	82.15	30.18	8.30	4.60	39.35	5.16	2467	971
	C_3S_1 bulk	28.64	82.43	30.50	8.40	5.15	40.93	5.23	2605	1066
C_3S_1	Pyramid x Acala	28.32	82.33	29.53	8.45	5.08	40.59	4.85	2202	894
	C315 x Acala U	29.34	83.70	29.53	8.35	4.78	40.21	5.39	2280	917
	ST825 x Acala U	28.70	82.98	30.65	8.45	5.30	39.83	5.16	2245	894
	FM966 x Acala U	29.15	82.45	30.08	8.13	4.78	39.14	5.01	2468	966
	M240 x Acala U	29.15	82.53	28.58	8.40	4.90	40.72	5.31	2560	1043
	HS26 x Acala U	29.34	82.68	30.70	8.10	4.90	40.67	5.46	2593	1055
	DP90 x Acala U	28.51	81.55	30.88	8.45	4.80	40.70	5.18	2508	1021
	SG747 x Acala U	28.77	82.65	31.60	8.40	4.88	40.46	5.28	1748	707
	PSC355 x Acala U	28.58	81.75	29.13	8.03	4.73	39.83	4.72	2348	935
	ST474 x Acala U	28.26	83.25	30.03	8.35	5.10	40.92	5.65	2112	864
	C315 x Pyramid	28.96	82.65	29.88	8.25	4.80	40.82	5.12	1855	757
	ST825 x Pyramid	28.32	81.95	30.13	7.95	4.80	39.40	5.13	2054	809
	FM966 x Pyramid	29.34	82.63	29.53	8.40	5.00	40.21	5.15	2046	823
	M240 x Pyramid	28.70	82.25	29.28	8.15	4.63	40.13	4.92	2536	1018
	HS26 x Pyramid	28.89	83.08	30.23	8.05	4.68	39.37	5.14	1971	776
	DP90 x Pyramid	28.83	82.43	29.60	8.30	4.73	39.72	5.15	2227	885
	SG747 x Pyramid	28.07	81.13	29.50	8.20	4.93	41.00	4.67	1153	472
	PSC355 x Pyramid	28.58	82.38	30.53	8.50	5.00	40.33	5.20	2360	952
	ST474 x Pyramid	28.26	82.50	30.28	8.25	4.80	39.57	4.99	1266	501
	ST825 x C315	28.96	82.95	30.30	8.40	5.08	40.28	5.32	2844	1145
	FM966 x C315	29.02	82.38	28.95	8.30	4.78	39.41	5.02	2069	815
	M240 x C315	28.32	82.90	30.50	8.40	5.15	40.33	5.30	2301	928
	HS26 x C315	29.15	82.35	29.65	8.10	4.80	39.77	4.70	1870	744
	DP90 x C315	29.15	82.68	29.38	8.10	4.55	38.98	4.71	1779	694
	SG747 x C315	28.64	82.05	28.70	8.15	4.83	40.08	4.50	1769	709
	PSC355 x C315	29.15	82.68	30.85	8.25	4.73	38.95	5.30	2571	1001
	ST474 x C315	28.79	82.27	31.87	8.30	4.93	40.63	4.98	1585	644
	FM966 x ST825	28.64	82.20	30.30	8.15	4.90	39.79	4.68	2603	1036
	M240 x ST825	28.77	82.70	30.40	8.20	5.05	40.14	5.30	2237	898
	HS26 x ST825	29.27	83.15	29.65	8.20	4.68	39.69	5.30	2705	1073
	DP90 x ST825	29.53	83.25	31.05	8.35	4.83	41.40	5.41	2704	1120
	SG747 x ST825	29.08	82.75	30.75	8.35	4.70	39.66	5.15	1890	749
	PSC355 x ST825	28.64	82.13	30.63	8.25	4.83	40.32	5.46	2347	946
	ST474 x ST825	28.89	83.43	29.83	8.53	5.00	41.23	5.02	2520	1039
	M240 x FM966	29.46	82.90	30.43	8.25	4.83	39.65	4.95	2373	941
	HS26 x FM966	29.59	83.20	31.83	8.30	5.03	40.02	5.06	2211	885
	DP90 x FM966	29.65	83.68	30.88	8.45	4.95	41.20	5.11	1673	689
	SG747 x FM966	28.70	82.65	29.83	8.20	4.78	39.88	4.96	2527	1008
	PSC355 x FM966	28.89	82.65	31.83	8.35	4.93	40.73	5.28	2433	991
	ST474 x FM966	28.70	82.98	29.45	8.40	5.20	41.35	5.46	2556	1057
	HS26 x M240	28.26	82.50	29.48	8.30	5.10	40.26	4.88	2061	830
	DP90 x M240	29.15	82.35	30.03	8.35	4.85	40.07	4.74	2176	872
	SG747 x M240	28.58	82.65	29.35	8.05	4.78	40.45	5.01	2358	954
	PSC355 x M240	29.40	83.35	32.63	8.73	4.95	39.65	5.28	2712	1075
	ST474 x M240	28.96	83.05	30.35	8.50	4.78	38.75	4.81	2283	885
	DP90 x HS26	28.77	81.70	30.78	8.20	4.95	41.54	5.12	2139	889
	SG747 x HS26	28.58	82.88	29.90	8.30	4.83	40.98	5.29	2226	912
	PSC355 x HS26	29.21	82.05	28.30	8.35	5.05	40.12	5.06	2448	982
	ST474 x HS26	28.38	81.83	29.50	8.45	4.68	40.38	5.15	1759	710
	SG747 x DP90	29.21	82.50	30.68	8.30	5.03	40.97	5.07	2313	948
	PSC355 x DP90	29.08	82.65	30.03	8.35	4.75	40.69	4.61	2030	826
	ST474 x DP90	28.89	81.55	29.93	8.40	4.60	39.93	4.64	2515	1004
	PSC355 x SG747	28.64	82.90	29.73	8.20	4.85	39.25	5.11	1663	653
	ST474 x SG747	29.34	83.10	31.35	8.25	4.88	40.12	5.51	2519	1011
	ST474 x PSC355	28.89	83.50	30.28	8.30	4.85	40.81	5.46	2605	1063
	LSD 0.05	0.86	1.17	1.97	0.38	0.36	1.22	0.05	837	336

[1]LEN = fiber length (mm), UR = fiber uniform ratio (%), STR = fiber strength (g/tex), ELO = fiber elongation (%), MIC = micronaire, LP = lint percentage (%), BW = boll weight (g), YLD = seed cotton yield (kg/ha), and LY = lint yield (kg/ha).

Conclusion

Parents had larger variances and ranges than F_2 hybrids and their corresponding populations at different cycles of random mating. The genetic variances among 55 F_2 populations decreased with the increased cycles of random mating. The means for parents showed significant differences from the population mean at different cycles of random mating for most traits measured. On the other hand, F_2 populations did not differ among different cycles for most traits. High correlations were detected among traits for parents and F_2 populations, while correlations among traits decreased with increased cycles of random mating. Higher correlations between F_2 and C_0S_1 were detected than those among other generations for most traits. Therefore, these results support the notion that the linkage blocks could be broken after one to four cycles of random mating. The random-mating populations should provide a genetic resource for selecting lines with improved agronomic and fiber traits.

There were no significant differences between bulked populations and means of 55 populations at different cycles of random mating. This finding suggests that mixed seed from the 55 populations are equivalent to represent 55 populations. Even though we only reported results from 55 populations with up to four cycles of random mating, the seeds from these populations at six cycles of random mating also will be available in the near future. Breeders should benefit from these genetic resources in the development of cotton lines with multiple improved traits through their own selection scheme.

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