Pima Cotton Improvement

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Summary

Several Pima strains, differing in plant type and maturity, yielded well at one or more of the ten test locations. Two relatively early maturing strains were equally well adapted below or above 2,500 feet elevation.

The Pima Regional Test was grown at eight locations in Arizona and two locations in Texas in 1980. Strains P34, P42, P43, P45 and P46 were developed at Phoenix under low-elevation conditions. P44, P47 and P48 were developed at Safford, and E14, E15, E16, P49 and P50 at El Paso under high-elevation conditions. Table 1 includes yield data from the ten locations - Phoenix, Coolidge, Salome, Wenden and Marana (2) below 2,500 feet elevation, and Safford (2), El Paso and Fabens above 2,500 feet elevation. Several strains, differing in plant type and maturity, yielded well at one or more of the ten test locations. P34, a strain slightly earlier than Pima S-5, averaged highest in yield. P45 was second highest in yield, was earlier than P34, and was determinate to the extent that regrowth did not occur in any test. These two strains were equally well adapted below or above 2,500 feet elevation. Other strains generally were adapted better either below or above 2,500 feet. The strains developed at low elevation generally were earlier and shorter statured than the strains developed at high elevation. The differences in earliness and height between the two groups were greater in tests at low elevation than in tests at high elevation.

The average fiber properties of the strains in the 10 Regional Tests are included in Table 2. Fiber lengths varied from slightly shorter to considerably longer than Pima S-5. Fiber strength and micronaire appeared to be within an acceptable range.

Advanced and Preliminary Tests of strains developed at low and high elevations were continued at Phoenix, Safford, El Paso and Fabens. At Phoenix, 28 strains were included in two advanced tests and 75 strains in three prelininary tests. Twenty-three of the 28 strains in the advanced tests and 59 of the 75 strains in the preliminary tests yielded significantly higher than Pima S-5.

Twenty-six advanced strains developed at high elevation were included in two advanced tests grown at four high-elevation locations. At these locations, eight, six, two and one of these strains yielded significantly higher than Pima S-5. None of the 10 strains included in the preliminary high-elevation test grown at two locations was significantly more productive than Pima S-5.

Table 1. Yields from Pima Regional Tests, 1980.

	Phoenix		Coolidge		Salome		Wenden		Marana (Station)		Marana (Clark)		Mean below 2,500' elevation	
	Pounds lint/A	Rank	Pounds lint/A	Rank	Pounds lint/A	Rank	Pounds lint/A	Rank	Pounds lint/A	Rank	Pounds lint/A	Rank	Pounds lint/A	Rank
P34	1240 bc*	4	972 a	2	1176 ab	3	1044 c	11	1218 a	1	1066 a	2	1119	3
P45	1190 c	5	886 ab	3	1253 a	1	1195 abc	6	1158 ab	3	1068 a	1	1125	2
P43	1345 a	1	998 a	1	983 c	14	1306 ab	3	1182 a	2	949 ab	5	1127	1
P48	1313 ab	3	879 ab	4	1067 bc	8	1209 abc	5	1120 ab	7	1045 ab	3	1106	4
Pima S-5	1166 c	6	810 ab	8	1168 ab	2	1304 ab	4	1038 bc	9	902 bc	8	1065	6
P47	984 de	8	843 ab	7	1123 abc	6	1088 bc	10	1121 ab	6	913 abc	7	1012	7
P44	920 ef	9	844 ab	6	1135 abc	5	1000 c	13	1145 ab	5	948 ab	6	999	8
P42	1314 ab	2	806 ab	9	1089 abc	7	1013 c	12	1152 ab	4	1037 ab	4	1069	5
E16	835 f	12	765 abc	11	1141 abc	4	1355 a	2	1041 bc	8	670 def	11	968	11
E15	865 f	10	797 ab	10	1050 bc	9	1366 a	1	1025 bc	10	711 de	10	969	10
P46	1058 d	7	853 ab	5	1037 bc	12	1139 abc	9	981 c	11	809 cd	9	980	9
P49	858 f	11	688 bc	12	1040 bc	11	1189 abc	7	945 cd	12	563 ef	13	881	12
E14	733 g	13	665 bc	13	1046 bc	10	1161 abc	8	849 de	13	530 f	14	831	13
P50	693 g	14	523 c	14	1011 bc	13	987 c	14	786 e	14	565 ef	12	761	14
C.V.	8.7%		23.3%		11.7%		16.0%		11.5%		14.3%			

Table 1. Continued.

	Safford (Curtis)		Safford (Layton)		El Paso, TX		Fabens, TX		Mean above 2,500' elevation		Mean all elevations	
	Pounds lint/A	Rank	Pounds lint/A	Rank	Pounds lint/A	Rank	Pounds lint/A	Rank	Pounds lint/A	Rank	Pounds lint/A	Rank
P34	1275 ab	3	805 bc	7	750 a	2	1190 a	1	1005	1	1074	1
P45	1268 ab	4	988 a	1	627 b-e	11	1061 a-e	7	986	3	1069	2
P43	1120 c	12	768 bc	9	692 abc	7	988 cde	11	892	12	1033	3
P48	1219 abc	6	733 cd	11	700 ab	6	964 de	12	904	11	1025	4
Pima S-5	1182 bc	9	733 cd	11	681 abc	9	1067 a-e	6	916	10	1005	5
P47	1325 a	1	838 b	2	713 abc	5	1080 a-d	5	989	2	1003	6
P44	1282 ab	2	814 bc	5	671 a-d	10	1000 cde	10	942	7	976	7
P42	1182 bc	9	659 d	14	544 e	14	934 e	14	830	14	973	8
E16	1120 c	12	828 bc	4	723 ab	4	1158 ab	3	957	5	964	9
E15	1170 bc	11	813 bc	6	689 abc	8	1048 b-e	8	930	8	953	10
P46	1119 c	14	673 d	13	581 de	13	1031 b-e	9	851	13	928	11
P49	1212 abc	7	787 bc	8	752 a	1	1189 a	2	985	4	922	12
E14	1210 abc	8	739 cd	10	600 cde	12	1120 abc	4	917	9	865	13
P50	1268 ab	4	829 bc	3	735 a	3	942 de	13	944	6	834	14
C.V.	7.2%		9.1%		10.6%		10.0%					

*In a given column, yields followed by the same letter are not significantly different at the 5% level.

Table 2. Average fiber properties from Pima Regional Tests, 1980.

	Fiber span length			Fiber strength	
	2.5%	50%	UR	T_1	Micronaire
Pima S-5	1.41	.67	48	31.3	3.77
P34	1.40	.69	50	32.7	4.03
P42	1.45	.70	48	31.3	3.76
P43	1.40	.69	49	32.6	3.99
P44	1.40	.66	47	31.1	3.82
P45	1.44	.69	48	33.7	3.98
P46	1.43	.70	49	33.0	3.84
E14	1.43	.68	47	31.1	3.92
E15	1.41	.68	48	31.7	3.63
E16	1.42	.67	48	32.7	3.53
P47	1.42	.71	50	34.6	4.17
P48	1.43	.70	49	33.4	3.68
P49	1.42	.69	48	31.5	3.96
P50	1.43	.70	49	31.4	3.73

Pima Cotton Genetics

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Summary

Hybrid cotton studies were continued by an evaluation of 33 Pima fertility restorer lines developed at Phoenix, Las Cruces, NM, and Athens, GA. These restorer lines showed varying degrees of heat tolerance with Phoenix derived lines generally performing best. The transfer of frego bract, nectariless, and glandless seed to Pima was continued. The conversion of twenty-three short-day G. barbadense germplasm stocks to a day-neutral habit was continued. The development of pure-line breeding stocks in one generation from F_1 plants was pursued through the use of doubled haploids derived via semigamy.

The inheritance of Pima mutant traits was studied to provide genetic information on potentially important characters and how these characters may be used to develop improved genetic populations. Thirty-three fertility restorer lines developed at Phoenix, Las Cruces, and Athens, Georgia showed varying degrees of heat tolerance as indicated by lack of pollen shed. The restorers developed at Phoenix showed the most heat tolerance and were the most productive. The transfer of genetic-cytoplasmic male sterility into six Pima experimental strains was begun. These stocks will increase the Pima germplasm available for possible use in hybrid cotton. The potential economic traits frego bract and nectariless for insect tolerance, and glandless seed for improved food and feed, and five dominant and nine recessive genetic markers continued to be transferred to Pima. A recessive leaf trait in experimental strain P32 was allelic with veins fused. Albivirescent-1 plant color was not allelic with virescent-5, -6. A dominant leaf trait in Pima S-3 was not allelic with crumpled leaves, veins fused, and Pima S-2 aberrant leaf. No new linkages were detected among 25 gene pairs tested in 1980.

Seed of 84 Gossypium barbadense L. primitive germplasm stocks were renewed for future use as sources of genetic variability. Twenty-three F_2 populations from crosses of short-day and day-neutral stocks were grown at Phoenix for seed production from flowering plants. This seed will be used to continue the conversion of the short-day stocks to a day-neutral habit allowing the primitive stocks to be evaluated under Arizona conditions during the summer. Twenty-nine primitive stocks from Peru were added to the collection. Requests for seed of 30 stocks were filled.

Additional haploids and doubled haploids from F_1 plants were produced via semigamy for pure lines in one generation. This procedure provides a more rapid means of establishing pure-line breeding stocks. The chromosome number of eight haploids from four F_1 sources was doubled with colchicine. An initial seed increase of 31 doubled haploids from six F_1 sources was made. Eighty-seven doubled haploids from six F_1 sources were evaluated for production potential. Eleven were rated above average for performance.

Several techniques were investigated that might be used to better identify heat tolerance in cotton. Differential leakage rates of electrolytes from leaf discs were converted to percent injury from heat stress. Electrolyte leakage reflected heat stress response of Pima S-5 and Pima S-3 but to a lesser extent than phenotypic differences observed in the field. Alexander's stain to estimate pollen abortion and a pollen germinating solution to estimate pollen viability indicated that pollen from dehiscent anthers was viable during July and August, 1980, from both heat tolerant and heat susceptible strains.