

# **Pima Cotton Improvement**

*R. G. Percy, E.L. Turcotte and I. M. Ray*

## ***Abstract***

*Pima experimental strains P73, P75, P76, P77, and the cultivars Pima S-6 (PS-6) and Pima S-7 (PS-7) were grown in replicated regional tests at twelve locations across the Pima belt in 1993. Tests were machine harvested for yield determination, plant heights were measured, and lint samples were collected for fiber analysis. Considerable genotype by environment interaction for yield potential occurred across tests in 1993. Across all locations, the strain P76 ranked first in yield followed by the cultivar PS-7 and strain P75. Strains P73 and P76 produced fiber of equal or greater length, strength, and elongation than PS-7. Plant heights were greatest for the entries PS-6 and P75. Entries PS-7 and P73 were intermediate in height, while P76 and P77 were the shortest of the entries tested. Considering yield and fiber properties concurrently, P76 was the superior entry of the 1993 tests.*

## **Introduction**

The Pima cotton improvement project, which is based at the Maricopa Agricultural Center, has as its objectives the development of higher yielding germplasm with increased tolerance to heat stress during the fruiting period, earliness to shorten the growing season for reduced irrigation and insect control inputs, and improved fiber for increased processing efficiency and end-use suitability. Regional tests of advanced experimental strains are conducted at several locations across the Pima belt for evaluation of yield potentials, agronomic traits, fiber quality, and ginning properties. Earlier generation strains are evaluated in Advanced and Preliminary tests conducted at low and high elevations. The program's breeding and germplasm development nursery is located at Maricopa.

## **Materials and Methods**

The Pima Regional Test was grown at 12 locations in the Pima belt in 1993. Pima S-6, Pima S-7, and four experimental strains, P73, P75, P76, and P77 were included in each test. The test locations below 2,500 ft. elevation included Yuma, Maricopa, Marana, and Aguila, AZ. Six locations above 2,500 ft included El Paso, TX, Fort Hancock, TX, La Mesa, NM, Las Cruces, NM, Thatcher, AZ and Safford, AZ. Test locations in California included Bakersfield and Tranquility. Tests were planted in replicated blocks with each entry planted as four, five, six or eight row strips through the field. Tests at Tranquility and Bakersfield, CA were grown on 30-inch row

spacing; the remaining tests varied from 36 to 40 - inch row spacing. Yields were based on two harvests at El Paso, TX, La Mesa, NM, Las Cruces, NM, and Thatcher, AZ. All other locations received a single harvest. Data from the Marana, AZ site were not included when computing mean yields across environments, because seed of P73 was damaged and failed to establish a stand. Plant heights were measured at the time of harvest. Replicated fiber samples collected from each location were analyzed for fiber properties by Starlab, Inc. The results of fiber analyses for the Aguila, AZ site were not received in time for this report. Statistical analyses were performed using a general linear model available on SAS.

## Results

Lint yields per acre for each Regional Test harvested in 1993 are presented in Table 1. Mean yields across locations are presented in Table 2. Strain yields averaged across two California locations indicate that PS-7 produced the highest yield followed by P77 and P76. Average strain yields across three low elevation tests (below 2,500 feet) in Arizona indicate that no strains outperformed the PS-7 check. Above 2,500 feet, strains P75 and P76 were ranked first and second in yield, respectively, and they consistently outyielded PS-7. The data indicate that P73 tended to perform best at low elevations while P75 performed best at high elevations. Across all locations, strain P76 ranked first in yield followed by PS-7 and then P75.

Plant heights of strains and cultivars are presented in Table 3. The cultivar PS-6 was the tallest entry across locations ranking first in California, first below 2,500 feet in Arizona, and second above 2,500 feet. The strain P75 was the second tallest entry across locations ranking second in California, second below 2,500 feet, and third above 2,500 feet. Entries P73 and PS-7 were intermediate in height, while P76 and P77 were consistently the shortest of the entries tested.

Fiber properties of strains and cultivars are presented in Table 4. Strains P73 and P76 produced fiber of equal or greater length, strength, and elongation than PS-7. Fiber from strain P75 was similar in length but significantly weaker than PS-7 fiber. The cultivar PS-6 produced the weakest fiber in these tests. All cultivars and strains produced fiber of similar micronaire, with the exception of P73 and P75 which produced a lower micronaire fiber. All strains produced acceptable ELS fiber, and were equivalent or superior to the current cultivars.

## Conclusions

Considerable genotype by environment interaction for yield potential occurred in the 1993 Pima Regional Tests. PS-7 was the highest yielding entry in the California and low elevation (below 2500 ft.) tests. Above 2,500 feet, strains P75 and P76 were ranked first and second in yield. The data indicate that P73 tended to perform best at low elevations while P75 performed best at high elevations. Across all locations, strain P76 ranked first in yield followed by PS-7 and then P75. Strains P73 and P76 produced fiber of equal or greater span length, strength, and elongation than PS-7. Plant heights were greatest for the entries PS-6 and P75. Entries PS-7 and P73 were intermediate in height, while P76 and P77 were the shortest of the entries tested. Considering yield and fiber properties concurrently, strain P76 was the superior entry of the 1993 tests.

Table 1. Yields from Pima Regional Tests, 1993.

Variety or strain	<u>Yuma</u>		<u>Maricopa</u>		<u>Marana</u>		<u>Aguila</u>		<u>Safford, Palmer</u>	
	Pounds Lint/A	Rank	Pounds Lint/A	Rank	Pounds Lint/A	Rank	Pounds Lint/A	Rank	Pounds Lint/A	Rank
Pima S-6	1079 d <sup>1</sup>	6	1060 ab	4	867 a	5	1651 b	6	971 a	1
Pima S-7	1640 a	1	1020 ab	5	917 a	4	1876 a	1	920 a	5
P73	1490 b	2	1121 a	2	----		1711 ab	5	941 a	3
P75	1170 d	5	912 b	6	946 a	3	1814 ab	2	936 a	4
P76	1351 c	3	1168 a	1	955 a	2	1740 ab	4	949 a	2
P77	1336 c	4	1087 a	3	976 a	1	1013 ab	3	842 b	6
C. V. (%)	5.9		9.1		9.0		6.0		3.8	

Variety or strain	<u>Safford Station</u>		<u>El Paso, TX</u>		<u>Las Cruces, NM</u>		<u>Las Mesa, NM</u>		<u>Fort Hancock, TX</u>	
	Pounds Lint/A	Rank	Pounds Lint/A	Rank	Pounds Lint/A	Rank	Pounds Lint/A	Rank	Pounds Lint/A	Rank
Pima S-6	692 bc	3	1025 b	4	1234 a	4	778 a	5	1205 a	2
Pima S-7	526 d	5	897 c	5	1228 a	5	848 a	3	955 c	5
P73	675 c	4	1155 a	2	1222 a	6	784 a	4	1060 b	4
P75	766 ab	2	1153 a	3	1314 a	2	911 a	2	1236 a	1
P76	634 c	5	1176 a	1	1331 a	1	932 a	1	1191 a	3
P77	834 a	1	814 c	6	1238 a	3	773 a	6	929 c	6
C.V. (%)	7.2		7.9		7.5		15.1		5.7	

Variety or strain	<u>Bakersfield, CA</u>		<u>Tranquility, CA</u>	
	Pounds Lint/A	Rank	Pounds Lint/A	Rank
Pima S-6	748 ab	6	1455 cd	6
Pima S-7	958 a	1	1745 a	1
P73	653 b	7	1666 ab	3
P74	825 ab	4	1330 d	7
P75	824 ab	5	1463 cd	5
P76	911 a	2	1590 bc	4
P77	842 ab	3	1679 ab	2
C.V. (%)	15.8		6.2	

<sup>1</sup> Yields in a given column not sharing letters in common are significantly different at the 0.05 probability level.

Table 2. Mean Yield Across Eleven† Locations in Pima Regional Tests, 1993.

Variety or strains	Across Locations Means											
	<u>California</u>		<u>Below 2,500'</u>		<u>Above 2,500'</u>		<u>All Locations</u>					
	lbs/acre	Rank	lbs/acre	Rank	lbs/acre	Rank	lbs/acre	Rank				
Pima S-6	1101	6	1263	5	984	4	1082	5				
Pima S-7	1351	1	1512	1	896	6	1147	2				
P73	1160	4	1441	2	973	5	1134	4				
P75	1143	5	1299	4	1053	1	1136	3				
P76	1251	3	1420	3	1036	2	1179	1				
P77	1261	2	1145	6	1034	3	1135	6				
C.V. (%)	11.0		7.0		7.9		8.2					

† Yield data from the Marana, Arizona site were not included.

Table 3. Plant Heights (cm) from Pima Regional Tests, 1993.

Variety or strain	Bakersfield CA	Tranquility CA	<u>California</u>		Yuma AZ	Maricopa AZ
			Mean	Rank		
PS-6	70 ab	112 a	91	1	165 a	115 b
PS-7	63 bc	107 a	85	4	130 c	105 c
P73	72 a	104 ab	88	3	130 c	105 c
P75	77 a	103 ab	90	2	152 b	128 a
P76	64 bc	94 cd	79	5	123 c	100 c
P77	61 c	90 d	76	6	130 c	105 c
C.V. (%)	7.4	5.7	6.6		5.8	5.4

Variety or strain	Marana AZ	Aguila AZ	<u>Below 2500'</u>		Safford AZ	Safford AZ (Palmer)	El Paso TX
			Mean	Rank			
PS-6	135 a	85 a	122	1	103 ab	77 a	96 a
PS-7	123 bc	74 b	103	5	89 c	68 bc	55 cd
P73	----	82 a	106	3	94 bc	76 ab	57 bc
P75	133 ab	83 a	121	2	107 a	72 ab	61 b
P76	110 d	70 b	98	6	85 c	63 c	50 d
P77	113 d	74 b	103	5	85 c	62 c	51 d
C.V. (%)	5.3	5.5 b	5.5		9.1	7.6	5.1

Variety or strain	Fort Hancock TX	Las Mesa NM	Las Cruces NM	<u>Above 2500'</u>		Across all Locations	
				Mean	Rank	Mean	Rank
PS-6	66 a	81 a	77 a	83	2	95	1
PS-7	55 cd	73 ab	72 ab	68	4	81	4
P73	57 bc	81 a	75 a	84	1	85	3
P75	61 b	71 ab	74 a	74	3	90	2
P76	50 d	76 ab	65 c	65	5	76	6
P77	51 d	65 b	67 bc	64	6	76	6
C.V. (%)	5.1	11.4	5.8	7.4		6.6	

Table 4. Mean Fiber Properties of Cultivars and Strains Across Eleven† Locations of the Pima Regional Test.

Variety or strains	Fiber span length		%	Fiber strength T <sub>1</sub> g/tex	Fiber elongation E <sub>1</sub>	Micronaire	Rd	b
	2.5%	50%						
PS-6	1.32 de	.63 c	47 b	30.7 f	8.1 b	4.4 a	66.5 d	12.9 a
PS-7	1.34 bc	.64 ab	48 ab	32.8 c	7.5 c	4.4 ab	67.3 c	11.6 c
P73	1.35 b	.65 a	48 a	34.0 a	7.8 cd	4.2 c	69.0 b	11.4 c
P75	1.34 b	.64 ab	48 ab	32.2 d	8.0 bc	4.3 bc	66.8 cd	11.8 b
P76	1.36 a	.64 ab	47 b	33.4 b	7.9 b-d	4.4 a	66.3 d	11.2 d
P77	1.32 e	.63 bc	48 a	31.5 e	8.6 a	4.3 ab	65.3 c	12.0 a
C.V. (%)	1.9	3.6	3.2	4.2	6.3	3.4	1.5	2.4

† Fiber data were not available from the Aguila, AZ site in 1993.