Pima Cotton Improvement

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Abstract

Pima experimental strains P73, P74, P75, P76, P77, P79 and the varieties Pima S-6 (PS-6) and Pima S-7 (PS-7) were grown in replicated Regional tests at ten locations across the Pima belt in 1992. Tests were machine harvested for yield determination, plant heights were measured, and fiber samples were collected for fiber analysis. Considerable genotype by environment interaction for yield potential occurred across tests in 1992. Across all locations, the cultivar PS-7 ranked first in yield followed by the strains P79 and P75. The cultivar PS-6 was the tallest entry in the tests, followed by P75. The strains P76, P77, and P79 were uniformly shorter. Considering yield and fiber properties concurrently, strain P75 was the superior strain entry of the 1992 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 1992. Pima S-6, Pima S-7, and six experimental strains, P73, P74, P75, P76, P77, and P79 were included in each test. The test locations below 2,500 ft. elevation included Yuma, Maricopa, and Marana, AZ. Two low elevation tests located at Wenden and Aguila, AZ were not included in analysis due to their poor performance. Test locations above 2,500 ft included El Paso, TX, Fort Hancock, TX, La Mesa, NM, and two locations at Safford, AZ. Test locations in California included Buena Vista 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, CA and El Paso, TX 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 Buena Vista, CA, La Mesa, NM, and El Paso, TX. All other locations received a single harvest. Plant heights were measured at the time of harvest. Replicated fiber samples collected from each location were analyzed for fiber properties by Starlab, Inc. Statistical analyses were performed using a general linear model available on SAS.

Results

Lint yields per acre for each Regional Test harvested in 1992 are presented in Table 1. Mean yields across locations are presented in Table 2. Strain yields averaged across two California locations indicate that three strains, P75, P77, and P79, were significantly better than the PS-6 check. Yields of the above strains did not differ significantly from the yield of the PS-7 check. Average strain yields across three lower elevation tests (below 2,500 feet) in Arizona indicate that one strain, P77, was superior to the PS-6 check. No strains out performed the PS-7 check at lower elevations. Above 2,500 feet, one strain, P75, out-performed the PS-7 cultivar. The cultivar PS-6 ranked first in yield above 2,500 feet. Across all locations, PS-7 ranked first in yield, followed by the strains P79 and P75. The strain P75, although ranked third across all locations, was conspicuous for its stability across environments. Strain P75 ranked third, fourth, and second in yield in California, below 2,500 feet, and above 2,500 feet respectively. Strain P77 was conspicuous for its high yield performance in California and below 2,500 feet (ranked first and second respectively), and its poor performance in tests above 2,500 feet (ranked eighth). Also of interest in 1992 was the complete reversal in yield rank of PS-6 and PS-7 between locations below 2,500 feet and above 2,500 feet.

Plant heights of strains and cultivars are presented in Table 3. The cultivar PS-6 was uniformly tall in California, below 2,500 feet, above 2,500 feet, and ranked first across locations. The strain P75, which displayed yield uniformity across environments, was a taller cotton, ranking second in California, third below 2,500 feet, and fourth above 2,500 feet. Across all locations, P75 ranked second in height. Strain P77, which displayed good yield performance in California and below 2,500 feet, was a shorter cotton and ranked eighth and fifth in those environments. Despite its poor yield performance above 2,500 feet, P77 retained its short plant height, ranking eighth at higher elevations. The strains P76 and P79 were also short statured cottons and displayed uniformity across environments.

Fiber properties of strains and cultivars are presented in Table 4. With the exceptions of P77 and P79, strains were superior to PS-6 in 2.5% span length, and were equivalent to or longer than PS-7. Similarly, with the exceptions of P77 and P79, strains were stronger than PS-6 and stronger than or equivalent to PS-7. The cultivar PS-6 and the strain P79 produced fiber with the highest micronaire. With the possible exception of P79, all strains produced acceptable ELS fiber, and were equivalent or superior to the current cultivars. Strain P79 was shorter than PS-6 or PS-7, weaker than PS-7, and equivalent to PS-6 in micronaire.

Conclusions

Considerable genotype by environment interaction for yield potential occurred in the 1992 Pima Regional Tests. Across all locations, the cultivar PS-7 ranked first in yield, followed by the strains P79 and P75. The P75 strain, though not a top yielding entry in any one environment, displayed greater stability across environments than did other entries. Less genotype by environment interaction was observed for cultivar and strain heights. The cultivar PS-6 was the tallest entry in the tests, followed by P75. The strains P76, P77, and P79 were uniformly shorter. Considering yield and fiber properties concurrently, strain P75 was the superior strain entry of the 1992 tests.

Publications

Turcotte, E.L., R.G. Percy, and C.V. Feaster. 1992. Registration of 'Pima S-7' American Pima cotton. Crop Sci. 32:1291.

Table 1. Yields from Pima Regional Tests, 1992.

Variety or strains	Buena Vista, Ca Pounds lint/A	Rank	Tranquility, CA Pounds lint/A	Rank	Yuma, AZ Pounds lint/A	Rank	Maricopa, AZ Pounds lint/A	Rank
Pima S-6	1148 ab[1]	4	1771 c	8	1134 b	6	611 de	6
Pima S-7	1172 a	2	1940 bc	5	1326 a	1	722 bc	4
P73	931 c	8	2159 ab	3	1230 ab	3	765 b	3
P74	1237 a	1	1771 c	7	947 c	8	583 e	7
P75	1167 ab	3	2043 ab	4	1150 b	5	767 b	2
P76	1141 ab	6	1921 bc	6	952 c	7	573 e	8
P77	1145 ab	5	2219 a	1	1233 ab	2	846 a	1
P79	1070 b	7	2187 ab	2	1211 b	4	681 cd	5
C.V. (%)	5.2		7.1		6.3		7.2	

Variety or strains	Marana, AZ Pounds lint/A	Rank	Safford, (Palmer) Pounds lint/A	Rank	Safford Station Pounds lint/A	Rank	El Paso, TX Pounds lint/A	Rank
Pima S-6	900 a	1	434 c	6	1013 bc	3	1255 a	1
Pima S-7	883 ab	3	499 b	2	828 d	7	1091 ab	2
P73	811 a-c	4	555 a	1	936 cd	5	882 cd	7
P74	746 c	8	494 b	3	821 d	8	902 b-d	6
P75	796 bc	7	468 bc	4	1220 a	1	994 bc	5
P76	887 ab	2	422 c	7	1076 b	2	1086 ab	3
P77	810 a-c	5	266 d	8	973 bc	4	734 d	8
P79	809 a-c	6	435 c	5	910 cd	6	1024 bc	4
C.V. (%)	7.3		8.5		8.2		12.5	

Variety or strains	Ft. Hancock, TX Pounds lint/A	Rank	LA Mesa, NM Pounds lint/A	Rank
Pima S-6	1134 a-c	5	1214 b	2
Pima S-7	1093 a-c	6	1148 bc	4
P73	1173 a-c	4	1142 bc	5
P74	1208 ab	2	1090 cd	7
P75	990 c	8	1368 a	1
P76	1174 a-c	3	1137 bc	6
P77	1067 a-c	7	1018 d	8
P79	1268 a	1	1159 bc	3
C.V. (%)	12.4		5.8	

[1] Yields in a given column not sharing letters in common are significantly different at the 0.05 probability level.

Table 2. Mean Yields Across Locations in Pima Regional Tests, 1992.

Variety or strain	Across Locations Means							
	California		Below 2,500'		Above 2,500'		All Locations	
	lbs/acre	Rank	lbs/acre	Rank	lbs/acre	Rank	lbs/acre	Rank
Pima S-6	1415 c[1]	8	882 c	6	1021 a	1	1051 ab	4
Pima S-7	1501 a-c	4	977 a	1	946 bc	6	1074 a	1
P73	1457 bc	7	935 a-c	3	959 a-c	5	1048 ab	5
P74	1466 bc	6	758 d	8	931 c	7	988 c	8
P75	1542 ab	3	904 bc	4	1006 ab	2	1051 ab	3
P76	1475 bc	5	804 d	7	997 a-c	3	1016 bc	6
P77	1605 a	1	963 ab	2	835 d	8	1007 bc	7
P79	1549 ab	2	900 bc	5	987 a-c	4	1073 a	2
C.V. (%)	6.6		8.6		11.0		9.9	

[1] Yields in a given column not sharing letters in common are significantly different at the 0.05 probability level.

Table 3. Plant heights (cm) from Pima Regional Tests, 1992.

Variety or strain	Buena Vista CA	Tranquility CA	California mean	Rank	Yuma AZ	Maricopa AZ	Marana AZ
Pima S-6	80 a[1]	130 a	102 a	1	124 a	161 a	128 a
Pima S-7	60 f	123 a	87 c	3	103 b	145 ab	110 bc
P73	72 bc	109 b	86 cd	4	101 b	135 bc	110 bc
P74	66 de	109 b	85 cd	5	95 c	131 bc	100 cd
P75	72 bc	128 a	96 b	2	105 b	137 bc	116 b
P76	62 ef	107 b	81 de	6	95 c	124 c	97 d
P77	63 d-f	92 c	75 f	8	95 c	132 bc	104 cd
P79	66 de	94 c	78 ef	7	102 b	122 c	102 cd
C.V. (%)	5.2	4.6	5.2		3.7	8.1	6.3

Variety or strain	Below 2,500' mean	Rank	Safford (Palmer) AZ	Safford AZ	El Paso TX	Fort Hancock TX	La Mesa NM
Pima S-6	112 a	1	66 a	66 ab	84 a	62 a	86 a
Pima S-7	98 b	2	58 b	60 b	62 bc	51 bc	70 b-d
P73	95 bc	4	60 b	70 a	68 b	58 ab	72 bc
P74	89 cd	6	51 cd	70 a	67 bc	55 a-c	65 d
P75	98 b	3	49 c-e	74 a	59 bc	49 c	74 b
P76	86 d	8	47 de	66 ab	63 bc	52 bc	65 d
P77	91 b-d	5	46 e	61 b	58 c	49 c	56 e
P79	88 cd	7	51 c	61 b	62 bc	56 a-c	68 cd
C.V (%)	9.2		4.9	7.4	8.3	11.1	5.4

Variety or strain	Above 2,500' mean	Rank	Across Locations mean	Rank
Pima S-6	72 a	1	96 a	1
Pima S-7	59 c	5	82 bc	4
P73	65 b	2	83 b	3
P74	61 c	3	79 cd	5
P75	60 c	4	84 b	2
P76	58 c	7	76 de	7
P77	54 d	8	74 e	8
P79	59 c	6	77 de	6
C.V. (%)	8.3		8.8	

[1] Plant heights in a given column not sharing letters in common are signicantly different at the 0.05 probability level.

Table 4. Fiber properties of cultivars and strains across eight locations of the 1992 Pima Regional Test.

Variety or strain	Fiber span length 2.5%	50%	UR	Fiber strength T_1	Fiber elongation E_1	Micronaire	Rd	b
	in.	in.	%	g/tex				
Pima S-6	1.33 c	.65 d	48 b-d	29.8 e	8.4 b	4.40 a	65.6 e	12.6 a
Pima S-7	1.34 b	.66 bc	49 bc	31.9 c	7.9 d	4.34 ab	67.0 c	12.0 cd
P73	1.35 b	.66 ab	49 ab	33.7 a	8.0 cd	4.18 d	68.1 b	11.9 d
P74	1.37 a	.66 ab	48 d	32.2 c	8.2 c	4.27 bc	70.1 a	11.1 f
P75	1.37 a	.66 ab	49 cd	32.2 c	8.2 c	4.09 e	67.3 c	12.1 c
P76	1.37 a	.67 a	49 bc	32.8 b	8.2 c	4.31 b	66.2 d	11.7 e
P77	1.33 c	.65 cd	49 ab	31.2 d	8.9 a	4.21 cd	64.8 f	12.4 b
P79	1.31 d	.65 d	49 a	29.6 e	8.5 b	4.40 a	67.8 b	12.0 cd
C.V. (%)	1.7	3.3	2.8	4.0	6.3	3.5	1.5	3.0