PIMA COTTON BREEDING AND GENETICS

Pima Cotton Improvement

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ABSTRACT

Five experimental strains, P65, P67, P68, P69, P70, and pima S-6 were grown in 9 regional tests across the pima belt in 1988. Mean yields from the 9 locations showed that P67 averaged highest in yield followed by P69, P70, P65, P68, and pima S-6, respectively. The difference in mean yield between P67, the highest yielding entry, and pima S-6 was 82 pounds of lint per acre. Pima S-6 was the latest maturing and tallest entry in the regional test at Maricopa. The 5 experimental strains had longer, finer, and whiter fiber than pima S-6.

INTRODUCTION

Pima cotton improvement is a long-term project with 3 objectives: 1) developing higher-yielding germplasm with increased tolerance to heat stress during the fruiting period; 2) earliness to shorten the season for reduced irrigation and insect control; and 3) fiber characteristics that improve processing efficiency and end-use suitability. Regional tests are conducted across the pima belt to evaluate advanced experimental strains in terms of the above objectives. Advanced and preliminary tests to evaluate agronomic, fiber, and yield performance of new strains are conducted at Maricopa, Marana, and Safford. Pima breeding nurseries are grown at the Maricopa Agricultural Center.

MATERIALS AND METHODS

The pima regional test was grown at 9 locations in the pima belt in 1988. Pima S-6 and 5 experimental strains, P65, P67, P68, P69, and P70 were included in each test. The test locations included Yuma, Poston, Wenden, Maricopa,and Marana, AZ, below 2,500 ft elevation; and Safford (Curtis), Safford Agricultural Center, AZ, La Mesa, NM, and El Paso, TX, above 2,500 ft elevation. The tests were planted in replicated blocks with each entry planted as a 4- or 6-row strip through the field. Yields were based on a once-over harvest for each location. Advanced and Preliminary tests were planted as randomized, small-plot tests with 5 replications at the Maricopa Agricultural Center and 4 replications at the Safford Agricultural Center. Yields from the small-plot tests were based on 2 harvests at Maricopa and a once-over harvest at other test sites. Fiber samples were tested in the fiber-testing laboratory at the Maricopa Agricultural Center.

RESULTS

Lint yields per acre for each regional test are presented in Table 1. Mean yields from the regional tests below 2,500 feet elevation at Yuma, Poston, Wenden, Maricopa, and Marana showed that P67 averaged highest in yield followed by P69, P70, P68, P65, and pima S-6. The difference in yield between P67, the highest-yielding strain, and pima S-6, the lowest-yielding entry, was 161 pounds of lint per acre. Mean yields from the regional tests above 2,500 feet elevation at Safford (Curtis), Safford Agricultural Center, La Mesa, and El Paso, showed that pima S-6 averaged highest in yield followed by P65, P69, P67, P70, and P68. The difference in mean yield between pima S-6 and P68, the lowest-yielding entry, was 108 pounds of lint per acre.

Mean yields combining all 9 regional test locations showed that P67 averaged highest in yield, followed by P69, P70, P65, P68, and pima S-6, respectively. The difference in mean yield between P67 and pima S-6 was 82 pounds of lint per acre. Yields from the regional tests reflect the 1988 production season, which had a period of cold and wet weather during planting, very hot night temperatures in Arizona in July, and hot, wet weather in Arizona in October. The 1988 weather conditions resulted in lower average yields per acre across the pima belt when compared with pima yields in recent years.

Sequential harvests of the regional test at Maricopa showed that P65, P67, and P69 were the earliest-maturing strains. P68 and P70 also were earlier than pima S-6.

Plant heights for the 5 strains and pima S-6 in each regional test except Yuma are given in Table 2. Plant heights varied from location to location. Mean plant heights combining locations showed that the 5 "P" designated strains averaged 4- to 6-inches shorter in height than pima S-6.

Mean boll and fiber properties from the strains grown at 9 regional test locations are given in Table 3. Compared with pima S-6, the 5 "P" designated strains had similar boll properties, whiter fiber, and longer and finer fiber. P68 and P70 had slightly weaker fiber than pima S-6.

Advanced strains were grown at Maricopa, Marana, and Safford in 1988. The tests included 18 advanced strains, P65, P67, P68, P69, P70, and pima S-6. Two Preliminary strains tests were grown at Maricopa and Safford in 1988. Each Preliminary test included 18 strains, P65, P67, P68, P69, P70, and pima S-6. Several advanced and preliminary strains exceeded pima S-6 in yield potential and ginning and fiber properties. Those strains will be evaluated further in 1989 tests.

The pima breeding nursery at Maricopa contained strains in several stages of development from early generations onward. Fifteen crosses were made in 1988 to generate additional variability for desired traits in pima cotton.

Table 1. Lint yields per acre from Pima Regional Tests, 1988.

	Yuma		Poston		Wenden		Maricopa	
	Pounds lint/A	Rank	Pounds lint/A	Rank	Pounds lint/A	Rank	Pounds lint/A	Rank
Pima S-6	858 c*	6	943 c	6	1109 a	2	969 d	6
P65	1084 b	5	1106 b	4	1114 a	1	1012 cd	5
P67	1250 a	2	1220 a	1	1039 ab	5	1075 ab	2
P68	1108 b	3	1107 b	3	1073 a	4	1088 a	1
P69	1268 a	1	1099 b	5	976 b	6	1059 a-c	3
P70	1103 b	4	1129 ab	2	1091 a	3	1028 bc	4
C.V.	3.3%		4.7%		3.6%		2.9%	

	Marana		Mean below 2,500'		Safford (Curtis)		Safford Station	
	Pounds lint/A	Rank	Pounds lint/A	Rank	Pounds lint/A	Rank	Pounds lint/A	Rank
Pima S-6	600 c	6	896	6	1094 b	3	1234 cd	5
P65	618 c	5	987	5	1068 b	5	1412 ab	2
P67	702 b	3	1057	1	1125 ab	2	1447 a	1
P68	699 b	4	1015	4	1063 b	6	1191 d	6
P69	813 a	1	1043	2	1075 b	4	1330 a-c	3
P70	799 a	2	1030	3	1181 a	1	1298 b-d	4
C.V.	7.5%				3.8%		6.2%	

	Le Mesa, NM		El Paso, TX		Mean above 2,500'		Mean all locations	
	lint/A	Rank	lint/A	Rank	lint/A	Rank	lint/A	Rank
Pima S-6	797 a	1	961 a	1	1022	1	952	6
P65	664 b	3	903 ab	3	1012	2	998	4
P67	621 bc	4	826 b	5	1005	4	1034	1
P68	591 bc	5	811 b	6	914	6	970	5
P69	692 b	2	948 a	2	1011	3	1029	2
P70	533 c	6	871 ab	4	971	5	1004	3
C.V.	8.9%		6.7%					

*Yields in a given column followed by the same letter are not significantly different at the 5% level of probability.

Table 2. Plant heights in inches from eight Pima Regional Tests, 1988.

	Poston	Wenden	Maricopa	Marana	Safford (Curtis)
Pima S-6	61 a*	35 a	54 a	69 a	38 a
P65	48 c	28 b	54 a	67 ab	35 b
P67	46 c	30 ab	48 b	64 bc	33 c
P68	54 b	28 b	52 ab	65 abc	34 bc
P69	53 b	29 ab	52 ab	66 ab	33 c
P70	54 b	24 b	49 b	61 c	35 b
C.V.	3.4%	14.0%	5.1%	4.8%	3.7%

	Safford (Station)	La Mesa, NM	El Paso, TX	Mean
Pima S-6	39 a	33 a	28 a	45
P65	39 a	28 b	21 b	40
P67	39 a	30 ab	21 b	39
P68	38 a	33 a	21 b	41
P69	39 a	30 ab	21 b	40
P70	35 a	29 b	24 ab	39
C.V.	11.7%	5.8%	10.6%	

*Heights in a given column followed by the same letter are not significantly different at the 5% level of probability.

Table 3. Mean boll and fiber properties of Pima S-6 and five experimental strains from Pima Regional Tests, 1988.

Variety or Strain	Grams per boll	Seeds per boll	Seed index	Percent lint	Lint index	R_d	b
	g	no.	g	%	g		
Pima S-6	3.27	16	13.1	37.8	8.0	68.3	10.8
P65	3.18	16	11.9	38.1	7.3	76.4	8.5
P67	3.03	16	11.4	39.3	7.4	76.6	8.4
P68	3.48	18	12.3	37.6	7.4	71.6	10.0
P69	3.16	16	12.1	37.2	7.1	69.8	10.3
P70	3.46	18	12.1	38.0	7.4	71.5	10.1

Variety or Strain	Fiber span length 2.5%	50%	UR	Fiber Strength T_1	Elongation E_1	Micronaire
	in.	in.	%	g/tex		units
Pima S-6	1.33	.65	49	31.4	12.6	3.78
P65	1.41	.68	48	33.5	12.3	3.72
P67	1.37	.66	48	33.3	12.5	3.77
P68	1.38	.63	46	31.1	11.8	3.40
P69	1.36	.66	49	33.3	12.0	3.70
P70	1.38	.63	46	30.5	11.7	3.49