Pima Cotton Breeding and Genetics

E. L. Turcotte and R. G. Percy, USDA-ARS, Cotton Research Center, Phoenix, AZ

Abstract

Five experimental strains and Pima S-6 were grown in seven Regional Tests across the Pima belt in 1986. P67 averaged highest in yield below 2,500 feet, and P65 averaged highest in yield above 2,500 feet elevation. Overall, Pima S-6 yielded 5% less than P67, the top yielding strain across locations. A new monogenic recessive aberrant leaf mutant in Pima was named wrinkled leaf-2 and assigned the gene symbol wr2.

Introduction

The Pima Regional Test was grown at seven locations in the Pima belt in 1986. Pima S-6 and five experimental strains, P64, P65, P66, P67, and P68, were included in the test. The test locations included Maricopa, Wenden, and Marana, AZ(all below 2,500 feet elevation); and Safford (Curtis) and Safford Station, AZ, LaMesa, NM and El Paso, TX (all above 2,500 feet elevation).

Yield levels in Arizona reflected a good production season while those in LaMesa, NM and El Paso, TX were reduced from those reported in 1985. As shown in Table 1, P67 averaged highest in yield at locations below 2,500 feet and second highest at locations above 2,500 feet. It was followed by P65, which was second and first in yield below and above 2,500 feet, respectively.

Pima S-6 was not significantly different in yield from the highest ranking strain in three of the Regional Tests, and overall it yielded only 5% less than P67, the top yielding strain across locations.

Plant heights from the seven Regional Tests are recorded in Table 2. Pima S-6 was as tall as or taller than all other strains tested. This reflects the trend toward increased earliness and somewhat shorter plant height in newly developed Pima experimental strains.

Advanced and preliminary tests of strains developed at Phoenix and Maricopa were grown at Maricopa and Safford in 1986. The advanced test contained 14 experimental strains and Pima S-6. At Maricopa, four strains yielded significantly higher than Pima S-6 and six additional strains yielded nonsignificantly higher. Pima S-6 was the highest yielding strain in the advanced test at Safford, with 11 experimental strains approaching it in yield.

Two preliminary tests were grown. Preliminary test I contained 28 experimental strains and Pima S-6. Four strains yielded significantly higher than Pima S-6 at Maricopa.

Preliminary test II also contained 28 experimental strains and Pima S-6. In this test, three strains significantly exceeded Pima S-6 at Maricopa. At Safford, several strains equaled, but none significantly exceeded Pima S-6 in yield.

The strains in Preliminary Tests I and II varied from short to intermediate in plant height and all strains were earlier in maturity than Pima S-6.

The Pima breeding nursery at Maricopa contained several progeny rows that expressed earlier maturity, shorter plant height, and higher yield potential than Pima S-6. Fifty-six advanced generation progenies were selected for spinning evaluation. Approximately 3,100 single plants were selected from F2, F3, and F4 populations for further evaluation.

These plant selections had various combinations of earliness, plant height, and productivity. Those with acceptable fiber will be advanced to the next generation and planted in the field in 1987.

A program to develop G. barbadense parents for G. hirsutum x G. barbadense interspecific F1 hybrids (ISH) continued. The desired Pima parent has been visualized as being early maturing, short statured, compact fruiting, and possessing "model" fiber properties. In 1986 a diallel analysis was performed to ascertain the degree of variability with the Pima germplasm for the desired traits and to determine what gains could be expected toward creating the desired Pima genotype.

Significant genotype variability and general combining ability estimates indicated useful genetic variation was present for fiber length and micronaire - the two traits in which selective advance was desired. Comparisons of general and specific combining ability components of variance indicated greater reserves of additive variability were available for fiber micronaire than for fiber length. Unfavorable associations between a shorter, coarser fiber and lint percentage and fiber strength were noted, but were not strong.

Results of the study suggest that selective advance toward a short, coarse fibered genotype can be made within the Pima germplasm, but that progress may be slow.

Breeding efforts toward the production of Pima ISH parental lines continued in 1986. Plant selections were made from F2 populations of diallel crosses judged to be superior. Individual plant selections were also made among F2 populations retained from the top cross performed in 1984. In all, 800 individual plants were selected for fiber anlaysis and further evaluation.

Efforts to collect and maintain a Gossypium barbadense L. germplasm collection for the purpose of providing a source of genetic diversity continued in 1986. Seed of 52 Gossypium darwinii Watt accessions from the Galapagos Islands and 32 G. barbadense and G. darwinii accessions from a Russian collection were added to the germplasm collection. Seed stocks of 151 germplasm accessions were renewed and placed in storage. Another 205 accessions were planted at Tecoman, Mexico for seed renewal. Descriptor notes were taken for 171 accessions. Requests for seed of 39 germplasm stocks were filled.

In the conversion of short-day accessions to a day-neutral habit, selected individuals of 36 BC1F2 and 1 BC2F2 populations were crossed with their respective short-day parents to advance them a generation. Sixty-eight BC1F2 and F2 populations were selected for day- neutral flowering segregates and transferred to the greenhouse for backcrossing to their parental stocks. Crossing was initiated at Tecoman, Mexico to introduce 100 new accessions into the conversion program.

A new monogenic recessive aberrant leaf mutant in Pima was named wrinkled leaf-2 and asigned the gene symbol wr2. Linkage tests between wr2 and 22 other Gossypium mutant genes were negative.

Table 1. Yields from Pima Regional Tests, 1986.

	Maricopa		Wenden		Marana		Mean below 2500'**	
	Pounds lint/a	Rank	Pounds lint/a	Rank	Pounds lint/a	Rank	Pounds lint/a	Rank
Pima S-6	1695*	c 6	961	ab 3	1247	bc 3	1301	5
P64	1828	ab 2	882	bc 5	1237	c 4	1316	4
P65	1766	bc 3	939	abc 4	1398	a 1	1368	2
P66	1723	bc 5	851	c 6	1144	c 6	1239	6
P67	1888	a 1	989	a 2	1368	ab 2	1415	1
P68	1757	bc 4	1000	a 1	1213	c 5	1323	3
C. V.(%)	4.2%		5.5%		6.3%			

**Yields in a given column followed by the same letter are not significantly different at the 5% level of probability.*
***Includes Maricopa, Wenden, and Marana, AZ.*

	Safford (Curtis)		Safford Station		LaMesa, NM	
	Pounds lint/a	Rank	Pounds lint/a	Rank	Pounds lint/a	Rank
Pima S-6	980 e	6	1346 b	3	797 a	1
P64	1073 bc	3	1225 bc	5	744 ab	4
P65	1124 a	1	1471 a	2	764 ab	2
P66	1002 de	5	1132 c	6	758 ab	3
P67	1082 b	2	1482 a	1	726 b	6
P68	1035 cd	4	1342 b	4	731 b	5
C. V. (%)	2.0%		6.0%		3.7%	

	El Paso, TX		Mean above 2500'***		Mean all locations	
	Pounds lint/a	Rank	Pounds lint/a	Rank	Pounds lint/a	Rank
Pima S-6	770 a	1	973	3	1114	4
P64	725 b	4	942	5	1102	5
P65	728 ab	3	1022	1	1170	2
P66	701 bc	5	898	6	1044	6
P67	678 c	6	992	2	1173	1
P68	742 ab	2	963	4	1117	3
C. V. (%)	3.1%					

****Includes Safford (Curtis) and Safford Station, AZ, LaMesa, NM, and El Paso, TX.*

Table 2. Plant heights from Pima Regional Tests, 1986.

	Maricopa	Wenden	Marana	Safford (Curtis)
		Inches		
P64	52 a*	32 ab	45 a	26 a
P65	54 ab	31 ab	45 a	28 ab
P66	52 a	29 a	45 a	28 ab
P67	50 a	28 a	42 a	29 b
P68	54 ab	28 a	41 a	26 a
Pima S-6	57 b	35 b	45 a	29 b
C. V. (%)	6.0%	8.3%	6.6%	5.5%

	Safford (Station)	LaMesa, NM	El Paso,TX	Mean
		Inches		
P64	29 a	34 a	26 a	35
P65	31 a	38 b	27 a	36
P66	31 a	33 a	25 a	35
P67	31 a	37 b	27 a	35
P68	31 a	39 b	30 b	36
Pima S-6	35 b	42 c	31 b	39
C. V. (%)	5.8%	3.2%	4.1%	

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

PUBLICATIONS

Turcotte, E. L. 1986. Round leaf-3 mutant in American Pima cotton. J. Hered. 77:364-366.

Turcotte, E. L. and Feaster, C. V. 1986. Registration of five American Pima cotton germplasm lines. Crop Sci. 26:206.

Turcotte, E. L. and Percy, R. G. 1986. Status and potential of exotic Gossypium barbadense L. germplasm. Agron. Abstr. p. 85. (Abstract)

Percy, R. G. 1986. Effects of environment upon ovule abortion in interspecific F1 hybrids and single species cultivars of cotton. Crop Sci. 26:938-942.

Percy, R. G. and Turcotte, E. L. 1986. Selection of short and coarse fibered Pima cottons as parents of interspecific hybrids. Agron. Abstr. p. 77. (Abstract)