Sea Island cottons (Gossypium barbadense L.) have long been known to be excellent sources of high fiber quality, possessing exceptional fiber length, strength, and fineness (Smith et al., 1999). However, historical Sea Island cultivars have exhibited late maturity, poor yield potentials, and high levels of heat sensitivity in comparisons with modern Pima cultivars. Sea Island cottons, along with Pima, Tanguis, Egyptian Giza, Coastland, and Upland sources, contributed to two hybrid gene pools from which modern Pima cultivars derive (Peebles, 1954; Feaster et al., 1967). Once created, these hybrid germplasm pools were maintained as closed breeding populations from the early 1950s until 1989, with no further introductions of germplasm contributing to their genetic diversity. In the past decade, public releases of Pima germplasm possessing Sea Island parentage have been made with the goals of reintroducing genetic diversity and broadening the genetic base of U.S. Pima while improving its fiber quality and maintaining levels of yield potential and heat tolerance acceptable to the commercial industry (Percy 1998; Percy 2002). The development and release of two Pima cotton germplasm lines, PSI 113 (Reg. No. GP-916, PI 655939) and PSI 425 (Reg. No. GP-917, PI 655940) are a continuation of these efforts.

PSI 113 and PSI 425, were developed by the USDA–ARS and New Mexico State Agricultural Experiment Station in 2008. The lines were developed to provide public and private breeders with agronomically improved resources for genetic improvement of fiber quality and to serve as genetic resources for broadening the germplasm base of Pima germplasm in the United States. Lines PSI 113 and PSI 425 originated from a cross made at New Mexico State University in 1997 of germplasm line 8810 and the Sea Island breeding line NMSI 1601, followed by individual plant selection within the F2, F3, and F4 generations and progeny selection in the F5 generation. Eight progeny lines, along with two commercial check cultivars and two high fiber quality check lines, were selected for evaluation in replicated tests at Maricopa, AZ, Shafter, CA, Westside, CA, and Las Cruces, NM, in 2005 and 2006. Across locations, lines PSI 113 and PSI 425 exhibited fiber lengths and strengths superior to commercial check cultivars and fiber yields not differing from the commercial cultivars. Lines PSI 113 and PSI 425 were selected for release from among the eight progeny lines on the basis of their overall agronomic performance and improved fiber characteristics across locations.

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ABSTRACT
Cotton (Gossypium barbadense L.) germplasm lines PSI 113 (Reg. No. GP-916, PI 655939) and PSI 425 (Reg. No. GP-917, PI 655940) were jointly developed and released by the USDA–ARS and New Mexico State Agricultural Experiment Station in 2008. The purpose of the release was to provide public and private breeders with agronomically improved resources for genetic improvement of fiber quality and to serve as genetic resources for broadening the germplasm base of Pima germplasm in the United States. Lines PSI 113 and PSI 425 originated from a cross made at New Mexico State University in 1997 of germplasm line 8810 and the Sea Island breeding line NMSI 1601, followed by individual plant selection within the F2, F3, and F4 generations and progeny selection in the F5 generation. Eight progeny lines, along with two commercial check cultivars and two high fiber quality check lines, were selected for evaluation in replicated tests at Maricopa, AZ, Shafter, CA, Westside, CA, and Las Cruces, NM, in 2005 and 2006. Across locations, lines PSI 113 and PSI 425 exhibited fiber lengths and strengths superior to commercial check cultivars and fiber yields not differing from the commercial cultivars. Lines PSI 113 and PSI 425 were selected for release from among the eight progeny lines on the basis of their overall agronomic performance and improved fiber characteristics across locations.
Experiment Station from a single plant selection within an open-pollinated synthetic population originating from the cultivar Monseratt Sea Island (PI 528388).

**Methods**

PSI 113 and PSI 425 were developed in a pedigree selection program at Las Cruces, NM, and Maricopa, AZ. Initial individual plant selection within the 8810/NMSI 1601 hybrid population occurred in the $F_2$ and $F_3$ generations at Las Cruces, NM, followed by a final series of individual plant selection in the $F_4$ generation in 2002 and progeny row selection in 2003 at Maricopa, AZ. Seed of selected plants were planted in progeny rows of 14 to 15 m and plant stands adjusted to a plant spacing of 23 to 30 cm. Individual plants were field selected on the basis of visual evaluation for yield potential, plant height, and plant architecture and subsequently reselected on the basis of fiber properties determined with individual instruments, rather than high volume instruments (HVIs). Reselection for fiber quality among selected plants emphasized 2.5% span length and fiber strength, as determined by stelometer using a 3.175-mm standard gage clamp distance. In 2003, eight progeny lines, including PSI 113 and PSI 425, were selected for evaluation in replicated tests, on the basis of visual evaluation of performance and fiber evaluation. Lines PSI 113 and PSI 425 were evaluated in replicated tests under the designations 010011-1-3 and 010004-2-5, respectively.

Replicated testing was conducted at Maricopa, AZ, Westside, CA, and Las Cruces, NM, in 2005 and 2006. A test at Shafter, CA, was added in 2006. Tests were arranged in a randomized complete block design with four replications of four-row plots (13–15 m by 4 m) at the Maricopa, AZ, Westside, CA, and Shafter, CA, locations and three replications of two-row plots at Las Cruces, NM. Standard production practices were followed in each test, including furrow irrigation. In addition to the eight selected progeny lines, all tests included the commercial cultivars PS-7 (PI 560140; Turcotte, Percy, and Feaster, 1992) and Phytogen 800 (U.S. Patent 7332.657) as agronomic and yield performance checks, and the germplasm lines 8810 and 89590 (PI 599428 and 599427; Percy and Turcotte, 1997) as superior fiber quality checks. Lint yields of test entries were determined by machine picking the two-row plots at the Las Cruces location or the interior two rows of all plots in the remaining locations. Plant heights of test plots were measured at the time of harvest. Fiber quality, lint percentage, and boll weight were determined from hand-harvested 50-boll samples, picked from all plots before machine harvesting. Fiber from 50-boll plot samples was evaluated using individual instruments (non-HVI). In reporting fiber strength, a conversion factor of 1.34 was applied to stelometer readings to approximate fiber strength as measured by HVI. The fiber quality variables 2.5% fiber length, length uniformity, strength, elongation, and micronaire were measured at all locations in both years, as were the agronomic variables fiber yield and lint percentage. Plant heights and boll weights were measured only in tests conducted at Maricopa, AZ, and Westside, CA, in both 2005 and 2006. All data were analyzed using SAS version 9.1 PROC GLM (SAS Institute, 2003).

**Characteristics**

Trait means for PSI 113 and PSI 425, tested as 010011-1-3 and 010004-2-5, respectively, over seven replicated tests at Maricopa, AZ, Shafter, CA, Westside, CA, and Las Cruces, NM, in 2005 and 2006, are shown in Tables 1 and 2. In the tests, lines 010004-2-5 and 010011-1-3 produced 2.5% span length of 37.2 and 37.6 mm, respectively, which were superior to the span lengths of both the PS-7 (35.8 mm) and Phytogen 800 (36.3 mm) commercial check cultivars. The fiber length of 010011-1-3 was equivalent to that of the superior fiber length check line, 89590, which averaged 37.8 mm. Fiber length uniformity of 010004-2-5 (0.47) was equivalent to that of both commercial check cultivars.

Table 1. Mean fiber properties of 8810/NMSI 1601 cotton progeny and check lines over seven tests conducted at Maricopa, AZ, Shafter, CA, Westside, CA, and Las Cruces, NM, in 2005 and 2006.

<table>
<thead>
<tr>
<th>Entry</th>
<th>Length 2.5% span length</th>
<th>Length uniformity</th>
<th>Strength (stelometer)</th>
<th>Adjusted strength* (HVI)</th>
<th>Elongation</th>
<th>Micronaire</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>mm</td>
<td>%</td>
<td>kN m kg⁻¹</td>
<td></td>
<td>%</td>
<td></td>
</tr>
<tr>
<td>89590</td>
<td>37.8 a⁴</td>
<td>46 de</td>
<td>349 d</td>
<td>468 d</td>
<td>6.63 bc</td>
<td>3.80 f</td>
</tr>
<tr>
<td>0100011-1-3</td>
<td>37.6 ab</td>
<td>46 de</td>
<td>347 d</td>
<td>465 d</td>
<td>6.60 bc</td>
<td>4.34 bc</td>
</tr>
<tr>
<td>010005-3-2</td>
<td>37.4 a–c</td>
<td>47 cd</td>
<td>365 c</td>
<td>490 c</td>
<td>6.17 d</td>
<td>4.17 d</td>
</tr>
<tr>
<td>010004-3-5</td>
<td>37.4 a–c</td>
<td>47 cd</td>
<td>394 a</td>
<td>528 a</td>
<td>6.47 b–d</td>
<td>4.01 e</td>
</tr>
<tr>
<td>010004-1-5</td>
<td>37.2 bc</td>
<td>47 bc</td>
<td>388 a</td>
<td>519 a</td>
<td>6.27 cd</td>
<td>4.01 e</td>
</tr>
<tr>
<td>010004-2-5</td>
<td>37.2 bc</td>
<td>47 bc</td>
<td>371 bc</td>
<td>497 bc</td>
<td>6.69 b</td>
<td>4.30 bc</td>
</tr>
<tr>
<td>010011-2-4</td>
<td>37.2 bc</td>
<td>45 e</td>
<td>347 d</td>
<td>464 d</td>
<td>6.53 bc</td>
<td>4.39 ab</td>
</tr>
<tr>
<td>010011-2-1</td>
<td>37.1 c</td>
<td>46 de</td>
<td>347 d</td>
<td>465 d</td>
<td>6.67 b</td>
<td>4.28 c</td>
</tr>
<tr>
<td>010004-3-4</td>
<td>37.0 c</td>
<td>47 bc</td>
<td>387 a</td>
<td>518 a</td>
<td>6.49 b–d</td>
<td>4.07 e</td>
</tr>
<tr>
<td>‘Phytogen 800’</td>
<td>36.3 d</td>
<td>48 b</td>
<td>325 e</td>
<td>435 e</td>
<td>7.41 a</td>
<td>4.18 d</td>
</tr>
<tr>
<td>‘PS-7’</td>
<td>35.8 e</td>
<td>47 bc</td>
<td>332 e</td>
<td>445 e</td>
<td>6.70 b</td>
<td>4.46 a</td>
</tr>
<tr>
<td>8810</td>
<td>35.1 f</td>
<td>50 a</td>
<td>376 b</td>
<td>504 b</td>
<td>7.13 a</td>
<td>4.35 bc</td>
</tr>
</tbody>
</table>

*Additional information and characteristics from the original source.*
The fiber strength of 010004-2-5 did not differ significantly from the heights of the four check entries. Although several experimental lines (010004-3-4, 010004-3-5, and 010004-1-5) exhibited fiber strengths and micronaire values superior to those of 010004-2-5 and 010011-1-3 (Table 1), these lines displayed lower yield potentials and lint percentages than did 010004-2-5, 010011-1-3, or the commercial check cultivars Phytogen 800 and PS-7 (Table 2). Lines 010004-2-5 and 010011-1-3 were determined to be the best compromise candidates for germplasm release, balancing overall agronomic performance and fiber quality characteristics across locations. Released as PSI 425 and PSI 113, lines 010004-2-5 and 010011-1-3, broaden the germplasm pool of commercial Pima by introducing potential genetic diversity of Monserratt Sea Island into the modern germplasm pool, and offer new genetic variability for fiber improvement in Pima cotton.

**Table 2. Mean agronomic properties of 8810/NMSI 1601 cotton progeny and check lines over seven tests conducted at Maricopa, AZ, Shafter, CA, Westside, CA, and Las Cruces, NM, in 2005 and 2006.**

<table>
<thead>
<tr>
<th>Entry</th>
<th>Yield (kg ha⁻¹)</th>
<th>Plant height (m)</th>
<th>Boll weight (g)</th>
<th>Lint percent (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>'Phytogen 800'</td>
<td>1406 a²</td>
<td>1.36 a–c</td>
<td>3.08 a</td>
<td>36.9 c</td>
</tr>
<tr>
<td>'PS-7'</td>
<td>1369 ab</td>
<td>1.26 d</td>
<td>2.77 d</td>
<td>37.8 a</td>
</tr>
<tr>
<td>010004-2-5</td>
<td>1344 ab</td>
<td>1.38 ab</td>
<td>2.90 c</td>
<td>35.9 e</td>
</tr>
<tr>
<td>89590</td>
<td>1323 ab</td>
<td>1.27 d</td>
<td>3.06 ab</td>
<td>37.3 b</td>
</tr>
<tr>
<td>8810</td>
<td>1323 ab</td>
<td>1.29 cd</td>
<td>2.53 e</td>
<td>35.4 f</td>
</tr>
<tr>
<td>010011-1-3</td>
<td>1322 ab</td>
<td>1.32 a–d</td>
<td>2.92 c</td>
<td>36.8 cd</td>
</tr>
<tr>
<td>010011-2-1</td>
<td>1318 ab</td>
<td>1.33 a–d</td>
<td>2.87 cd</td>
<td>36.5 d</td>
</tr>
<tr>
<td>010011-2-4</td>
<td>1300 bc</td>
<td>1.25 d</td>
<td>2.95 bc</td>
<td>36.7 cd</td>
</tr>
<tr>
<td>010005-3-2</td>
<td>1214 cd</td>
<td>1.31 b–d</td>
<td>3.07 ab</td>
<td>34.4 i</td>
</tr>
<tr>
<td>010004-3-4</td>
<td>1203 cd</td>
<td>1.41 a</td>
<td>3.07 ab</td>
<td>35.3 fg</td>
</tr>
<tr>
<td>010004-3-5</td>
<td>1182 d</td>
<td>1.38 a–c</td>
<td>3.07 ab</td>
<td>35.0 gh</td>
</tr>
<tr>
<td>010004-1-5</td>
<td>1076 e</td>
<td>1.39 ab</td>
<td>2.99 a–c</td>
<td>34.6 hi</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Entry</th>
<th>Yield (kg ha⁻¹)</th>
<th>Plant height (m)</th>
<th>Boll weight (g)</th>
<th>Lint percent (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>8810</td>
<td>1323 ab</td>
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<td>2.77 d</td>
<td>37.8 a</td>
</tr>
<tr>
<td>89590</td>
<td>1323 ab</td>
<td>1.27 d</td>
<td>3.06 ab</td>
<td>37.3 b</td>
</tr>
<tr>
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</tr>
<tr>
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<td>36.5 d</td>
</tr>
<tr>
<td>010011-2-4</td>
<td>1300 bc</td>
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<td>36.7 cd</td>
</tr>
<tr>
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<td>1.31 b–d</td>
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<td>34.4 i</td>
</tr>
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</tr>
<tr>
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<td>1.38 a–c</td>
<td>3.07 ab</td>
<td>35.0 gh</td>
</tr>
<tr>
<td>010004-1-5</td>
<td>1076 e</td>
<td>1.39 ab</td>
<td>2.99 a–c</td>
<td>34.6 hi</td>
</tr>
</tbody>
</table>

†Values within a column followed by the same letter are not significantly different at the α = 0.05 probability level according to Waller–Duncan K-ratio t test.

References


