CHARACTERIZATION OF 79 CONVERTED RACE STOCKS OF UPLAND COTTON Zeki Nasirci and C. Wayne Smith Texas A&M University College Station, TX

<u>Abstract</u>

In 1993, the USDA released seventy-nine day-neutral race stocks. Studies were conducted at Weslaco and College Station, Texas to further document the HVI properties and to evaluate the yield and fiber characteristics of the 79 day-neutral race stocks. Several of the converted race stocks with favorable combinations of traits were identified.

Introduction

Seventy-nine day-neutral race stocks of upland cotton were released by the USDA in 1993. Each primitive accession was crossed as the male parent to Deltapine 14 and resulting F_2 progenies with the day-neutral flowering habit were selected for backcrossing to their respective primitive race stock parent (McCarty et al., 1979). Four backcrosses were made.

The primitive parents, or race stocks, are photoperiodic accessions of *Gossypium hirsutum* that are part of the USDA National Plant Germplasm Collection. The 79 primitive race stocks were collected in Mexico or Central America (USDA, 1987).

These race stocks are believed to contain valuable genes that can provide stress resistance or physiological enhancement of U.S. cultivars. The conversion of these stocks to day neutrality made these genes more accessible to plant breeders in the U.S.

Morphological characteristics, yield components, and fiber properties have been reported by the USDA. Yield components reported include boll size, seed index, lint percent, and lint index. Fiber properties included in the USDA descriptors include upper half mean length, T_o and T_1 strength, elongation, and micronaire. The purpose of this research was to further document the HVI fiber properties of these 79 converted race stocks and to investigate the most basic lint yield components, fiber weight and number per seed and per unit of seed surface area.

Objectives

 Develop BC₃ populations of each of these 79 converted race stocks by crossing and backcrossing to TAM 94L-25. The BC₃F₂ populations will be used to evaluate the

Reprinted from the Proceedings of the Beltwide Cotton Conference Volume 1:485-487 (1999) National Cotton Council, Memphis TN introgression of useful traits into an adapted upland type. (long term objective)

2. To further elucidate the characteristics of these 79 converted race stocks. (short term objective)

Materials and Methods

Seed of the 79 converted race stocks were obtained from Dr. Ed Percival, curator of the working cotton collection of the USDA National Plant Germplasm System. These were subsequently divided into two groups. The first group consisted of 26 lines and were planted at Weslaco, Texas along with Deltapine 50. The remaining 53 lines were planted at College Station along with a breeding line, TAM 94L-25, as the control.

Weslaco

Twenty-six converted race stocks were space planted in single row plots, 102 cm x 9 m. Cultural practices were normal for the locale, including furrow irrigation. A composite, hand harvested boll sample consisting of 25 normal, full size bolls were harvested from each of the converted race stocks and Deltapine 50 at maturity. These bolls were ginned on an 8-inch roller gin with fiber evaluated for HVI properties at the International Textile Center at Lubbock, Texas.

College Station

Fifty-three converted race stocks were space planted in single row plots, 102 cm x 12 m. Cultural practices were normal for the locale, including furrow irrigation. At maturity, five normal bolls were hand harvested from each of five plants of each converted race stock and four bolls from each of four plants of TAM 94L-25. Since the converted race stocks tended to be late maturing, first position bolls from the upper portion of the fruiting zone of TAM 94L-25 were harvested. Seeds and motes were counted, and motes removed prior to ginning on an 8-inch roller gin at the Cotton Improvement Laboratory. Fiber from each plant was evaluated for HVI and AFIS fiber properties (only HVI fiber data will be reported) at the International Textile Center at Lubbock.

Boll characteristics were determined by direct count or measurement. Within-boll lint yield components were determined as outlined by Worley et al. (1976) and Coyle and Smith (1997). Characteristics reported herein are:

Seeds/boll:total number of seeds per sample / number of bolls

Motes/boll:total number of motes per sample / number of bolls

% motes: [motes / (seeds + motes)] * 100

% lint: weight of lint / seedcotton weight

Boll size: seedcotton weight per sample / number of bolls

Seed index: weight of 100 fuzzy seeds

Lint wt./seed:lint weight per sample / number of seed per sample

Lint wt./cm² seed surface: (lint wt./seed) / surface area per seed

Fibers/seed: (lint wt./seed) / HVI mean length*mic Fibers/cm²: (Fibers/seed) / surface area per seed.

Results and Discussion

Weslaco

Because only a single boll sample was derived for each of the converted race stocks and Deltapine 50, no statistical analyses were possible. However, results in tables 1- 3 indicate that some of these 26 converted race stocks compare favorably with Deltapine 50 for a number of parameters. Several converted race stocks averaged more seeds per boll and larger seeds than Deltapine 50 (Table 1). The greater number of seed and larger seed contributed to greater seedcotton weight per boll for the converted race stocks.

Most of the Weslaco grown converted race stocks had coarser but stronger fibers than Deltapine 50 in 1998 (Table 2). All of the converted race stocks grown at Weslaco had lower elongation percentage.

None of the converted race stocks had greater within-boll yield components than Deltapine 50, although a few compared favorably (Table 3). Lint per unit seed surface area ranged from 3.4 mg for tx0017 to 5.5 for Deltapine 50 while fibers/cm² of seed surface ranged from 7,204 for tx0017 to 15,073 for Deltapine 50.

College Station

Statistical analyses were possible for the 53 converted race stocks and TAM 94L-25 grown at College Station during 1998. Because of the extremely hot summer experienced at College Station, the number of motes and percent motes were determined along with standard boll characteristics. TAM 94L-25 was used as the control genotype for the short term objective reported herein as well as the recurring parent for the long range objective. TAM 94L-25 is a breeding line of complex pedigree that includes PD, Paymaster, Lankart, Deltapine, Gregg, Fox 4, Acala, and Stoneville parents. TAM 94L-25 is competitive in lint yield in central and south Texas and has exceptional fiber quality, especially fiber length.

Since considerable plant to plant variability exist within each converted race stock and since plants were used to develop the error mean square in the analysis of variance, mean separation was not as precise as desirable. Even so, the analysis of variance and mean separation indicated some converted race stocks that differed from TAM 94L-25 and that would be the desirable converted race stock as parental material for a particular trait. Forty of the 53 converted race stocks had more seeds/boll than TAM 94L-25). Not only did most of the converted race stocks have more seeds/boll, 50 had fewer motes/boll. Although this comparison was not designed to determine the effects of stress on ovule fertilization and seed development, fewer motes/boll suggests that the converted race stocks contain genes for heat tolerance as one of the traits commonly associate with excessive heat is poor ovule fertilization/seed development. High temperatures during the growing season at College Station exceeded 38 C (100 F) for 39 days (30 consecutive days).

TAM 94L-25 had larger seed than 51 of the 53 converted race stocks. Even with the low seed number per boll and high % motes, the boll size of TAM 94L-25 was equal to the converted race stock, tx0117, having the heaviest bolls.

Only four of the converted race stocks had coarser fibers than TAM 94L-25 and none had significantly finer fibers according the HVI analysis. Twenty-nine of the 53 converted race stocks had fiber length equal to TAM 94L-25 and only one had weaker fibers. Tx0088 was numerically the strongest entry tested at 33.8 g/tex, averaging 3.7 g/tex more than TAM 94L-25.

Seed surface area was not determined for TAM 94L-25 so these 53 converted race stocks are not compared with TAM 94L-25 for lint wt./cm² nor fibers/cm². As was the case with Deltapine 50 and the 26 converted race stocks evaluated at Weslaco, TAM 94L-25 at College Station produced numerically the most lint/seed and lint/cm² of seed surface area. However, sixteen converted race stocks produced statistically an equal amount of lint/seed and thirteen produced an equal number of fibers/seed.

Conclusions

- 1. Most of the converted race stocks produced more seeds/boll than the control genotype at both Weslaco and College Station, and had fewer motes/boll that TAM 94L-25 at College Station. These results may indicate genes for heat tolerance.
- 2. The converted race stocks tend to have coarser and shorter fibers. However, a number of the converted race stocks have relatively strong fibers with acceptable elongation.
- 3. Within-boll yield components of a few converted race stocks compared favorably with the control genotypes. None were superior.
- 4. However, converted race stocks can be identified with favorable combinations of traits. For example, tx0117 exhibited competitive lint weight per seed and per seed surface area along with more seeds/boll, fewer motes/boll, and good fiber properties. Tx0117 also had large seedwhich could be advantageous from the oil mill/feed industry perspectives.

Literature Cited

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Table 1. Boll characteristics of 26 converted race stocks and Delatpine 50 grown at Weslaco, TX during 1998.

	Seeds / boll	Percent lint	Boll size	Seed Index
Race Stock	(No.)	(%)	(g)	(g)
DPL-50	28.5	37.1	4.2	9.4
tx0002	32.4	31.7	5.0	10.6
tx0007	32.8	30.7	4.5	9.5
tx0017	31.8	26.3	4.5	10.2
tx0024	31.4	32.0	4.2	9.1
tx0030	32.5	30.9	5.3	10.3
tx0031	33.7	32.1	4.8	9.6
tx0032	25.6	31.9	3.7	9.8
tx0033	35.5	28.5	5.6	11.1
tx0036	33.8	29.4	5.9	12.1
tx0040	33.9	28.9	5.2	11.0
tx0043	31.3	33.3	5.0	10.7
tx0045	25.2	30.7	4.2	10.2
tx0048	36.3	32.5	6.0	10.1
tx0053	33.2	31.2	4.5	11.1
tx0055	35.4	30.5	5.6	10.9
tx0057	32.2	33.6	4.5	9.3
tx0060	31.7	30.4	5.0	11.1
tx0061	36.7	31.6	5.9	10.7
tx0062	30.3	29.2	5.3	12.6
tx0063	34.2	29.4	5.5	11.6
tx0067	32.3	34.1	5.9	10.7
tx0068	31.6	30.8	5.1	11.1
tx0072	33.7	29.5	5.0	10.5
tx0074	34.7	29.7	5.4	11.0
tx0076	30.8	26.9	5.0	11.9
tx0077	33.0	30.7	5.0	10.4

Data based on composite sample of 25 hand harvested bolls.

able 2. Fiber characteristics of 26 converted race stocks and Deltapine 50 grown at Weslaco, TX during 1998.

Race Stock	Mic.	Lg.	Str.	UR	Eling.
DPL-50	4.5	1.09	27.0	84	6.3
tx0002	4.7	1.07	28.2	85	5.5
tx0007	4.9	1.07	27.6	85	5.4
tx0017	4.8	0.99	28.0	84	5.4
tx0024	4.6	1.13	27.8	84	5.4
tx0030	4.6	1.12	28.5	84	5.7
tx0031	5.1	1.02	27.2	83	5.5
tx0032	5.5	1.01	28.0	84	5.5
tx0033	5.6	0.98	26.2	83	5.2
tx0036	5.1	1.05	27.6	84	5.5
tx0040	4.8	1.08	29.3	84	5.3
tx0043	4.8	1.06	27.7	84	5.3
tx0045	5.0	1.05	29.0	85	5.5
tx0048	5.4	1.03	26.8	84	5.2
tx0053	5.2	1.06	29.0	85	5.6
tx0055	5.0	1.04	29.2	85	5.4
tx0057	5.2	1.07	28.0	86	5.7
tx0060	4.8	1.13	29.5	83	5.4
tx0061	4.5	1.11	29.8	85	5.7
tx0062	5.2	1.04	29.1	85	5.4
tx0063	4.3	1.09	29.6	85	5.7
tx0067	5.3	1.04	25.7	85	5.8
tx0068	4.8	1.11	30.1	85	5.3
tx0072	5.3	1.01	27.2	85	4.9
tx0074	5.2	1.07	29.4	85	5.4
tx0076	5.2	0.99	28.6	84	5.4
tx0076	4.8	1.10	28.5	85	5.6

Data based on composite sample of 25 hand harvested bolls.

Table 3. Within-boll lint yield components of 26 converted race stocks and Deltapine 50 grown at Weslaco, TX during 1998.

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Race	Lint wt. /	Fibers / seed	Lint wt. / seed	Fibers / seed			
Stock	seed (mg)	(No.)	(mg)	(No.)			
DPL-50	5.5	15,147	5.5	15,073			
tx0002	4.9	12,069	4.5	10,959			
tx0007	4.3	10,975	4.2	10,782			
tx0017	3.7	7,816	3.4	7,204			
tx0024	4.3	11,369	4.0	10,705			
tx0030	5.0	12,144	4.6	11,244			
tx0031	4.5	11,746	4.4	11,372			
tx0032	4.6	11,529	4.6	11,309			
tx0033	4.5	10,836	4.0	9,722			
tx0036	5.2	12,820	4.4	10,996			
tx0040	4.5	11,176	4.1	10,184			
tx0043	5.3	13,820	4.9	12,684			
tx0045	5.1	11,161	4.7	10,287			
tx0048	5.4	12,469	4.8	11,203			
tx0053	4.3	12,282	3.8	10,838			
tx0055	4.8	11,498	4.7	11,389			
tx0057	4.7	11,000	4.6	10,750			
tx0060	4.8	11,542	4.4	10,653			
tx0061	5.1	11,900	5.2	12,014			
tx0062	5.1	12,493	4.1	10,000			
tx0063	4.7	13,484	4.1	11,759			
tx0067	6.3	14,107	5.4	12,167			
tx0068	5.0	11,855	4.5	10,546			
tx0072	4.4	10,503	4.2	10,101			
tx0074	4.6	11,294	4.2	10,329			
tx0076	4.4	10,892	3.8	9,388			
tx0077	4.6	11,247	4.3	10,422			

Data based on composite sample of 25 hand harvested bolls