# SUPERIOR NEW MAR COTTON GERMPLASM FOR DROUGHT, PRODUCTIVITY AND QUALITY

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## Introduction

The main objective of the multi-adversity resistance (MAR) cotton genetic improvement program is to breed, develop and release MAR cotton strains and varieties for the Southwest USA cottonbelt. These lines combine high yield potential and early maturity, improved fiber and seed quality, drought tolerance, higher levels of resistance to insects and pathogens, and stability and wide adaptability to the diverse Texas environments. The MAR germplasm is extensively field tested at ten locations which include the major cotton growing regions from the Rio Grande Valley to the Rolling and High Plains, and represents a wide range of diverse environments. Severe drought and abnormally high temperatures occurred at most locations which effected yield, boll size and fiber quality. This allowed for the identification of new MAR-7B and MAR-8 superior strains with drought tolerance. The objective of this paper is to compare among the MAR germplasm the effect of this year's drought on yield and fiber quality.

## Materials and Methods

Twenty-four advanced MAR strains were tested in the Uniform MAR test (UMAR) as part of the four-stage MAR field testing procedure. The UMAR tests were planted in replicated tests at six locations. Test locations ranged from minimum input, rain-fed production areas as in Corpus Christi, Thrall and McGregor to high input, irrigated production areas as in Weslaco, the Brazos Valley and Chillicothe. Evaluation of germplasm in these diverse locations is excellent for determining stability of yield and fiber quality traits across a range of different environments and to determine the adaptability and potential of new germplasm for a specific environment.

Performance data of the advanced MAR-7B and MAR-8 germplasm were collected on agronomic traits, drought tolerance, resistance to insects and pathogens, lint yield, earliness, and fiber quality traits. All tests were sequentially harvested at two dates to determine earliness and total yield. Fiber samples were tested, utilizing the High Volume Instrument (HVI) double line, at the International Textile Center, Texas Tech University, Lubbock, TX. Superior strains combining the many desired traits are being identified and selected.

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## Results and Discussion

Rainfall in the dryland locations was minimal in 1998. Corpus Christi received 2.07 inches of rain for a March planting, and a total of 0.36 inches rainfall during the growing season (Table 1). Thrall had 2.12 inches in March at planting and 0.97 inches during the growing season. McGregor was planted in mid-April with sufficient moisture and had sufficient rainfall during the growing season. However, with the extreme high temperatures in June and July in Texas, the moisture was insufficient for optimum crop development. The three dryland tests were harvested by the end of July.

In 1997, the test locations had average rainfall. Figure 1 compares lint yield for three irrigated and three dryland UMAR tests in 1997 and 1998. Under irrigation, yield averaged 937 lb/a in 1997 compared to 773 lb/a in 1998, a 21% reduction in yield. In the three dryland locations, yield averaged 456 lb/a in 1997 and 364 lb/a in 1998, a 25% reduction.

The data presented in Table 2 is abstracted from the 1997 Uniform MAR tests at seven locations. Yield ranged from 785 lb to 1013 lb/a for SPNXCDUG8H-1-95 in the irrigated plots with an overall mean of 919 lb/a. In the non-irrigated tests, yields ranged from 791 lb/a for HQCULHQPIH-1-95 to 1010 lbs/a for CABU2HGC8H-2-91. Yield for cultivars in the non-irrigated locations were higher in some cases than the irrigated plots, due to the high yields at Corpus Christi and Temple in 1997.

In 1998, averaged over the three irrigated locations, yield ranged from 667 for Deltapine 50 to 877 lb/a for CIQBCHGC8H-1-96 with an overall mean of 773 lb/a (Table 3) compared to 919 lb in 1997. Averaged of the three dryland tests, yield ranged from 358 lb/a for HQCULHQPIH-1-95 to 426 lb for SPNXCDUG8H-1-95, with an average of 364 lb/a compared to 752 lb/a in 1997. Several strains that produced the highest yield in the 1997 tests including SPNXCDUG8H-1-95, CABU2HGC8H-2-91 and PD22CUBQWS-1-95 were also the highest yielding strains in the 1998 tests. HQCULHQPIH-1-95 had the greatest reduction yield in 1998 compared to 1997 under the two growing environments, and Paymaster PM330 was the least effected.

Fiber quality is influenced by water stress. Fiber strength is less effected than the other fiber traits under drought conditions. Under irrigated conditions, fiber strength ranged from 29.2 g/tex for Deltapine 50 to 32.4 g/tex for Tamcot Sphinx (Table 4). Under non-irrigated conditions, fiber strength decreased to 25.6 g/tex for SPNXCDU8H-1-95 and 29.0 g/tex for Paymaster PM330. The cultivars with the highest yielding ability had the greatest reduction in

fiber strength under drought conditions, particularly SPNXCDU8H-1-95 and CIQBCHGC8H-1-96.

Water stress reduces fiber length. Fiber length ranged in the irrigated plots from 1.06 inches for Paymaster 330 to 1.14 inches for PD22CUBQWS-1-95. In the non-irrigated plots, length ranged from 0.98 for SPNXCDUG8H-1-95, CABU2HGC8H-2-91 and Paymaster 330 to 1.07 inches for Deltapine 50. Fiber length for Tamcot Sphinx and the higher yielding cultivars were effected more by water stress, and Deltapine 50 was least effected.

Micronaire is the fiber quality trait that was the most effected by water stress, and the most variable across diverse environments. Under irrigated conditions, micronaire ranged from 4.1 for CIQBCHGC8H-1-96 and PD22CUBQWS-1-95 to 4.9 for Deltapine 50. Under dryland conditions, micronaire ranged from 3.7 for PD22CUBQWS-1-95 to 4.4 for Deltapine 50 and Tamcot Sphinx. The values were in the premium range between 3.5 and 4.9.

## Conclusion

High temperatures and low rain in 1998 gave the opportunity to test MAR germplasm under extremely diverse environments. The development of cultivars that are adapted and stable under all diverse conditions is a major objective of the MAR program. Progress in improving fiber quality for production in dryland areas has been achieved in the advanced MAR-7B germplasm. The new MAR-7B and MAR-8 strains that yielded the most under optimum conditions in 1997 were also the highest yielding strains under sub-optimum and severe drought in 1998. The strains are SPNXCDUG8H-1-95, CABU2HGC8H, HQCULHQPIH-1-95 and PD22CUBQWS-1-95. However, the fiber quality of these strains was most effected by the severe stress, but quality was within the premium range. These strains will be further tested and released to the cotton industry and commercial cotton breeders.

Table 1. Rainfall amount for dryland locations at Corpus Christi, Thrall and McGregor, Texas.

| Month | Corpus Christi | Thrall | McGregor |
|---|---|---|---|
| | | Inches | |
| March | 2.07 | 2.12 | 3.11 |
| April | 0.02 | 0.68 | 2.25 |
| May | 0.00 | 0.23 | 1.28 |
| June | 0.34 | 0.06 | 1.92 |
| July | 0.67 | 0.20 | 0.62 |
| Total | 3.06 | 2.68 | 9.18 |

Table 2. Total lint yields of cotton varieties and MAR strains in 1997 Uniform Test over irrigated and non-irrigated locations.[1]

| MAR Strain/Cultivar | Non-Irrigated | Irrigated | Mean |
|---|---|---|---|
| | | lb/a | |
| SPNXCDUG8H-1-95 | 1013** | 882** | 948** |
| HQCULHQPIH-1-95 | 811 | 791 | 801 |
| CABU2HGC8H-2-9 | 846 | 1010 | 928 |
| PD22CUBQWS-1-95 | 819 | 914 | 867 |
| Tamcot Sphinx ck | 888 | 860 | 874 |
| Paymaster 330 ck | 785 | 867 | 826 |
| Test Mean | 919 | 752 | 836 |
| LSD (*P*=0.05) | 94 | 103 | 84 |

[1] Abstracted from a 24 entry test.

** Significant at the 0.05 probability level.

Table 3. Total lint yield of cotton varieties and MAR strains in 1998 Uniform Test over irrigated and non-irrigated locations.[1]

| MAR Strain/Cultivar | Irrigated | Non-Irrigated | Percent Reduction |
|---|---|---|---|
| | lb/a | lb/a | % |
| SPNXCDUG8H-1-95 | 848** | 426** | 49.7* |
| CIQBCHGC8H-1-96 | 877 | 390 | 55.6 |
| CABU2HGC8H-2-91 | 829 | 400 | 51.7 |
| HQCULHQPIH-1-95 | 848 | 358 | 57.8 |
| PD22CUBQWS-1-95 | 818 | 387 | 52.5 |
| Paymaster PM330 ck | 709 | 428 | 39.6 |
| Tamcot Sphinx ck | 720 | 406 | 43.7 |
| Deltapine 50 ck | 667 | 364 | 45.5 |
| Test Mean | 773 | 364 | 52.9 |
| LSD (*P*=0.05) | 88 | 58 | 5.0 |

[1] Abstracted from a 24 entry test.

*, ** Significant at the 0.05 probability level.

Table 4. Mean fiber strength of cotton varieties and MAR strains in the 1998 Uniform Test over irrigated and non-irrigated locations. [1]

| MAR Strain/Cultivar | Irrigated | Non-Irrigated | Percent Reduction |
|---|---|---|---|
| | g/tex | g/tex | % |
| SPNXCDUG8H-1-95 | 29.8** | 25.6** | 14.2* |
| CIQBCHGC8H-1-96 | 30.5 | 26.1 | 14.3 |
| CABU2HGC8H-2-91 | 30.4 | 27.2 | 10.7 |
| HQCULHQPIH-1-95 | 32.1 | 28.3 | 11.6 |
| PD22CUBQWS-1-95 | 31.2 | 28.4 | 8.9 |
| Paymaster PM330 ck | 30.7 | 29.0 | 5.7 |
| Tamcot Sphinx ck | 32.4 | 28.5 | 11.9 |
| Deltapine 50 ck | 29.2 | 28.1 | 4.0 |
| Mean | 31.7 | 28.7 | 9.5 |
| LSD (*P*=0.05) | 1.5 | 1.2 | 6.0 |

[1] Abstracted from a 24 entry test.

*, ** Significant at the 0.05 probability level.

Table 5. Mean fiber length (U.H.M) of cotton varieties and MAR strains in the 1998 Uniform Test over irrigated and non-irrigated locations. [1]

| MAR Strain/Cultivar | Irrigated | Non-Irrigated | Percent Reduction |
|---|---|---|---|
| | Inches | Inches | % |
| SPNXCDUG8H-1-95 | 1.08** | 0.98** | 9.3* |
| CIQBCHGC8H-1-96 | 1.10 | 1.00 | 9.1 |
| CABU2HGC8H-2-91 | 1.08 | 0.98 | 9.3 |
| HQCULHQPIH-1-95 | 1.13 | 1.03 | 8.8 |
| PD22CUBQWS-1-95 | 1.14 | 1.04 | 8.8 |
| Paymaster PM330 ck | 1.06 | 0.98 | 7.5 |
| Tamcot Sphinx ck | 1.13 | 1.01 | 10.6 |
| Deltapine 50 ck | 1.13 | 1.07 | 5.3 |
| Mean | 1.12 | 1.03 | 8.0 |
| LSD (*P*=0.05) | 0.02 | 0.02 | 2.5 |

1 Abstracted from a 24 entry test.

*, ** Significant at the 0.05 probability level.

Table 6. Mean micronaire of cotton varieties and MAR strains in the 1998 Uniform Test over irrigated and non-irrigated locations. [1]

| MAR Strain/Cultivar | Irrigated | Non-Irrigated | Percent Reduction |
|---|---|---|---|
| SPNXCDUG8H-1-95 | 4.6** | 4.2** | 10.2* |
| CIQBCHGC8H-1-96 | 4.1 | 3.9 | 5.9 |
| CABU2HGC8H-2-91 | 4.4 | 4.0 | 9.9 |
| HQCULHQPIH-1-95 | 4.2 | 4.1 | 2.6 |
| PD22CUBQWS-1-95 | 4.1 | 3.7 | 9.0 |
| Paymaster PM330 ck | 4.7 | 4.3 | 8.3 |
| Tamcot Sphinx ck | 4.8 | 4.4 | 8.6 |
| Deltapine 50 ck | 4.9 | 4.4 | 11.9 |
| Mean | 4.4 | 4.0 | 8.4 |
| LSD (*P*=0.05) | 0.3 | 0.2 | 7.7 |

[1] Abstracted from a 24 entry test.

*, ** Significant at the 0.05 probability level.

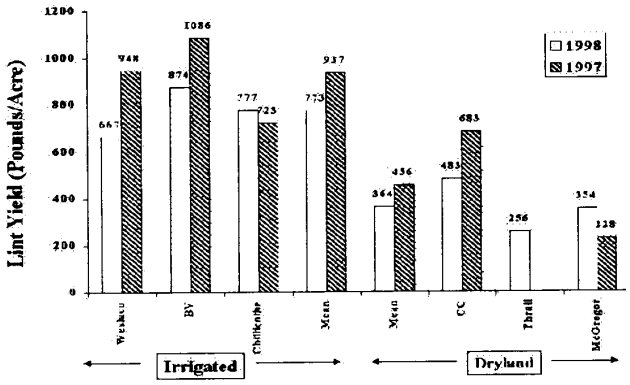


Figure 1. Mean lint yield for MAR cotton strains and varieties in the 1998 Uniform MAR (UMAR) Test at six locations, three irrigated and three dryland, and averaged over locations.