

NOTICE OF RELEASE OF 'TAMCOT PYRAMID' COTTON

P. M. Thaxton and K. M. El-Zik
Texas Agricultural Experiment Station
Texas A&M University
College Station, TX

Abstract

'Tamcot Pyramid' cotton (*Gossypium hirsutum* L.) was developed in the multi-adversity resistance (MAR) cotton genetic improvement program and released in May 2000 by the Texas Agricultural Experiment Station (TAES). The established MAR system was the breeding procedure used to develop Tamcot Pyramid (Bird 1982; El-Zik and Thaxton 1989). The MAR techniques and procedures utilize specific seed, seedling and plant selection in the laboratory and greenhouse in the fall and winter, followed by an extensive four-stage field testing and evaluation at ten locations throughout Texas, from the Rio Grande Valley to the Rolling and High Plains. These procedures make it possible to identify superior cotton germplasm with the simultaneous genetic improvement for resistance to pests (insects and plant pathogens) and abiotic stresses, in addition to drought tolerance, and improved yield, earliness, and fiber and seed quality (Thaxton and El-Zik 1994, 1996, 1999, 2000).

Tamcot Pyramid was developed from a cross between the MAR lines CD3PIHP45H-2-89 and CD3HGCBU8S-1-91. Individual F3 plants were selected using the MAR laboratory-greenhouse procedures. An F4 single seed descent field progeny row was selected in 1995 and given the strain designation SPNXCDUG8H-1-95. CD3PIHP45H-2-89 was released as Tamcot Sphinx in 1995 and originated from the cross between CDP37HPIH-1-1-96 and a selection from Paymaster 145. CD3HGCBU8S-1-91 originated from the cross between the MAR lines CD3HCAHUGH-2-88 and CABUCAG8US-1-88.

Tamcot Pyramid is a hairy (pubescent), glanded, normal leaf and normal bract cotton. It is nectaried and leaves are dark green. It has a cylindrical shaped growth habit, short internodes, and storm resistant bolls. Plants are of medium height, taller (4 cm) than Tamcot Sphinx (El-Zik and Thaxton 1994) and shorter (2.5 cm) than Paymaster 330. Flowers from plants of Tamcot Pyramid will have cream pollen.

Tamcot Pyramid was tested extensively throughout Texas and in Oklahoma for four years for resistance to insects and pathogens, drought tolerance, agronomic characteristics, earliness, productivity, and fiber quality performance (Thaxton and El-Zik 1996, 1999, 2000). Data were collected from 36 tests conducted in Texas over four years, 1996-1999, at 12 sites (Weslaco, Corpus Christi, College Station, Temple, Thrall, McGregor, Hill County, Chillicothe, Halfway). The tests included the 1996 Early Field Planting (EFP) test at four locations (32 genotypes and four replications) and the 1997-1999 Uniform MAR (UMAR) test at eight locations with 24 genotypes and four replications. Data were abstracted from the above described tests and statistically analyzed to compare Tamcot Pyramid performance with Tamcot and commercial cultivars.

Tamcot Pyramid had field stand ability and vigor equal to the recent Tamcot cultivar releases. Tamcot Pyramid had stand of 61% seedling survival as percent of planted seed as compared to 43.1% for the susceptible genotype (Table 1). Tamcot Pyramid was similar to Tamcot Sphinx and Paymaster PM330 for seedling survival. Tamcot Pyramid is highly resistant to the bacterial blight pathogen. It carries the $B_2B_3B_7$ genes that confer high levels of resistance to *Xanthomonas campestris* pv. *malvacearum* (Smith) Dye the causal agent of bacterial blight. Tamcot Pyramid was evaluated in the Verticillium wilt nursery at Halfway from

1996 to 1999. Tamcot Pyramid has similar levels of resistance to Verticillium wilt (38.2%) as Tamcot Sphinx (38.2%) and Paymaster PM330 (30.2%), compared to 27% for the highly resistant genotype and 80% for the susceptible genotype (Table 1). Based on weekly counts of Phymatotrichum root rot disease symptoms, Tamcot Pyramid had a similar level of resistance as Tamcot Sphinx and Paymaster PM330 (Table 1). In the 1997 National Fusarium wilt nursery at Tallassee, Alabama, Tamcot Pyramid averaged 58% plants with wilt symptoms compared to 89.0% for the susceptible genotype Rowden and 21% for the highly resistant genotype M-315 (Table 1).

In a reniform nematode infested (RN) field test at Weslaco, Tamcot Pyramid produced 1102 lb of lint per acre (ranked 9th highest yield out of 36 entries) in the non-treated RN plots and 1237 lb/acre in the treated plots (5th highest yield). Yield ranged from 755 to 1272 lb/acre in the non-treated RN plots, and from 825 to 1391 lb/acre in the treated plots. Tamcot Pyramid produced high yields in both the RN infested and fumigated plots indicating it has levels of resistance to the reniform nematode.

Levels of resistance to insects were determined by including cultivars and genotypes with known levels of resistance and susceptibility in the tests for comparison with Tamcot Pyramid, Tamcot Sphinx, and Tamcot CAB-CS. Presence of cotton insects and damage caused was noted in the MAR Strains, EFP and UMAR tests throughout the season, and tests were evaluated and a grade of one (very little damage) progressing to five (severe insect damage) was assigned to each plot. Tests were harvested sequentially to determine early and total lint yield, which are indicators of early, mid- and late season insect damage. Extensive grading and evaluation indicated that Tamcot Pyramid has higher resistance levels to seven insects: aphids, thrips, fleahopper, boll weevil, budworm, bollworm, and whitefly, and to spider mites than Tamcot CAB-CS (Bird et al. 1986) and similar resistance levels to Tamcot Sphinx (Table 2).

Eight genotypes; Tamcot Pyramid, Tamcot Luxor, Tamcot Sphinx, four elite MAR-7 lines and a susceptible genotype, were evaluated for levels of resistance to four insects at Chillicothe, Texas in 1996 (Parajulee et al. 1997). No insecticides were applied throughout the season. Sampling consisted of weekly monitoring of plots from plant emergence to late August. Tamcot Pyramid had the lowest levels of damage to thrips, fleahopper, boll weevil and boll worm (Table 3). Boll weevil punctured bolls ranged from 4.2% for Tamcot Pyramid to 19.3% for the susceptible genotype.

Results from 38 tests conducted over four years (1996-1999) were used to compare Tamcot Pyramid (SPNXCDUG8H-1-95) lint yield per acre with other advanced MAR lines, Tamcot and commercial cultivars. Tests included the EFP, UMAR, and tests conducted in the Texas High Plains and Oklahoma. The MAR tests were grown at 10 locations across Texas in the major cotton growing regions, which represent a wide range of diverse environments including pest pressures and water stress.

The summary results from 17 tests over four years showed that Tamcot Pyramid produced the highest lint yield (836 lb/acre), significantly 10% more than Tamcot Sphinx and Paymaster PM 330, both averaging 763 lb/acre (Table 4). It is an early maturing cultivar similar in maturity to Tamcot Sphinx (Table 4). Tamcot Pyramid produced the highest lint yield at each location and year, indicating its wide adaptation and stability over the diverse growing and environmental conditions in Texas. Tamcot Pyramid has a significantly larger boll (82 bolls per pound of seed cotton) than Tamcot Sphinx and Paymaster 330 (Table 4). Its lint percentage and gin turnout were similar to those of Tamcot Sphinx and Paymaster 330.

Yield components of Tamcot Pyramid in comparison with Tamcot Sphinx and Paymaster PM 330 are presented in Table 5. Tamcot Pyramid and Paymaster PM330 produced similar number of seeds/boll and both

produced more seeds/boll than Tamcot Sphinx. Seed index was similar for the three cultivars. Tamcot Pyramid produced more lint/seed (lint index) than either Tamcot Sphinx or Paymaster PM330, and produced a larger boll than both the comparison cultivars (Table 5).

Fiber quality characteristics of Tamcot Pyramid are generally similar to that of recent Tamcot cultivar releases. Results from 17 EFP and UMAR tests over four years indicated that fiber length and uniformity of Tamcot Pyramid are similar to those of Paymaster 330 (Table 6). Fiber length of Tamcot Pyramid was 0.03 inches shorter and strength was 2.1 g/tex lower than Tamcot Sphinx, however, all fiber characteristics are within the premium quality range. The fiber of Tamcot Pyramid is finer (4.1 micronaire units) than that of Tamcot Sphinx (4.4 units) and Paymaster 330 (4.5 units).

The Foundation Seed Service of the Texas Agricultural Experiment Station will produce, maintain and sell foundation seed to producers of registered and certified classes. Seed of Tamcot Pyramid will be available in 2001 to growers from four Texas seed companies. Tamcot Pyramid has U. S. Plant Variety Protection (PVP) requiring that it be sold by variety name only as a class of certified seed.

Acknowledgment

This research was supported in part by the Texas Food and Fibers Commission and the Texas State Support Committee-Cotton Incorporated. We acknowledge with appreciation the efforts of the Multi-Adversity Resistance (MAR) Cotton Genetic Improvement Program staff, the cooperation of Texas and Oklahoma Agricultural Experiment Station researchers and Extension staff in the testing of this variety at their locations.

References

Bird, L. S. 1982. The MAR (multi-adversity resistance) system for genetic improvement of cotton. *Plant Dis.* 66:172-176.

Bird, L. S., K. M. El-Zik, and P. M. Thaxton. 1986. Registration of (Tamcot CAB-CS) upland cotton. *Crop Sci.* 26:384-385.

El-Zik, K. M. and P. M. Thaxton. 1989. Genetic improvement for resistance to pests and stresses in cotton. p. 191-224. *In* R. E. Frisbie, K. M. El-Zik, and L. T. Wilson (Eds.) *Integrated Pest Management Systems and Cotton Production*. John Wiley & Sons, New York.

El-Zik, K. M. and P. M. Thaxton. 1996. Registration of 'Tamcot Sphinx' cotton. *Crop Sci.* 36:1074.

Parajulee, M. N., J. E. Slosser, P. M. Thaxton, and K. M. El-Zik. 1997. Quantifying levels of resistance to cotton insect pest in multi-adversity resistance (MAR) germplasm. Entomology Program. Vernon Research Center Technical Report No. 97-01.

Thaxton, P. M. and K. M. El-Zik. 1994. Genetic enhancement of MAR cottons for resistance to insects and pathogens, yield and fiber quality. *Proc. Beltwide Cotton Prod. Res. Conf., Cotton Improv. Conf.* 46:658-661. Natl. Cotton Coun. Am., Memphis, TN.

Thaxton, P. M. and K. M. El-Zik. 1996. Genetic advance in new multi-adversity resistance (MAR) cotton germplasm. *Proc. Beltwide Cotton Prod. Res. Conf., Cotton Improv. Conf.* 48:601-611. Natl. Cotton Coun. Am., Memphis, TN.

Thaxton, P. M. and K. M. El-Zik. 1999. Superior new MAR cotton germplasm for drought, productivity and quality. *Proc. Beltwide Cotton Conf., Cotton Improv. Conf.* 51:470-472. Natl. Cotton Coun. Am., Memphis, TN.

Thaxton, P. M. and K. M. El-Zik. 2000. Comparative characteristics of recent and prospective Tamcot cultivar releases. *Proc. Beltwide Cotton Conf., Cotton Improv. Conf.* 52:521-524. Natl. Cotton Coun. Am., Memphis, TN.

Table 1. Mean percent field stand, disease symptoms and/or plant death for Tamcot cultivars and reference genotypes.

| Cultivar/ Genotype | Field Stand¹ | Bacterial Blight² | Verti- cillium Wilt³ | Phymato- trichum Root Rot⁴ | Fusarium Wilt⁵ |
|--|------------------------------------|---|--|--|--------------------------------------|
| | % | Grade | % | % | % |
| Tamcot Pyramid | 61.0 | 1.1 | 38.2 | 22.5 | 58 |
| Tamcot Sphinx | 61.0 | 1.1 | 38.2 | 16.9 | --- |
| Paymaster 330 | 62.0 | --- | 32.5 | 17.4 | --- |
| Susceptible genotype | 43.1 | 7.8 | 80.0 | 75.0 | 89 |
| Resistant genotype | 61.5 | 1.1 | 27.0 | 18.0 | 21 |
| Mean | 57.7 | --- | 43.2 | 30.0 | 56.0 |
| LSD (<i>P</i> = 0.05) ⁶ | 10.3 | 2.1 | 11.8 | 14.4 | 18.7 |

¹ Based on performance of 1996 Early Field Planting Tests and 1997-1999 Uniform MAR tests.

² Reaction to U.S. races of the bacterial blight pathogen, on a grade scale of 1 (immunity) to 10 (fully susceptible).

³ Mean performance (percentage of plants with symptoms) in the 1996-1999 Halfway Strains tests.

⁴ Mean performance (percentage of dead plants) in the 1997 and 1999 UMAR tests at Thrall.

⁵ Mean performance in the 1997 Fusarium wilt nursery in Tallassee, Alabama.

⁶ Least significant difference between two means within a column.

Table 2. Response of Tamcot Pyramid to insects in comparison with Tamcot cultivars and susceptible cotton genotypes.

| Cultivar | Aphids | Thrips | Flea- hopper | Boll Weevil | Bud- worm | Boll- worm | White- fly |
|-------------------------|------------------|---------------|-------------------------|------------------------|----------------------|-----------------------|-----------------------|
| Tamcot Pyramid | 2.2 ¹ | 1.8 | 1.5 | 2.3 | 2.4 | 2.5 | 1.9 |
| Tamcot Sphinx | 2.0 | 2.0 | 1.6 | 2.4 | 2.6 | 2.5 | 2.1 |
| Tamcot HQ95 | 2.1 | 2.2 | 1.7 | 2.5 | 2.8 | 2.8 | 2.4 |
| Tamcot CAB-CS | 2.9 | 2.8 | 2.5 | 2.9 | 3.1 | 3.0 | 1.9 |
| Susceptible genotype | 4.2 | 4.4 | 4.4 | 4.5 | 4.7 | 4.7 | 4.8 |

Mean of 17 tests conducted over a four year period (1996-1999).

¹ Based on a grade scale of 1 (very little damage) progressing to 5 (severe damage).

Table 3. Damage due to insect pests in the 1996 no insecticide test at Chillicothe, Texas.

| Cultivar | No. Thrips per plant | No. Flea-hoppers per plant | % punctured bolls Boll weevil | % punctured bolls Bollworm |
|----------------------|-----------------------------|-----------------------------------|--------------------------------------|-----------------------------------|
| Tamcot | | | | |
| Pyramid | 0.47 | 0.25 | 4.2 | 1.0 |
| Tamcot | | | | |
| Luxor | 0.62 | 0.36 | 7.8 | 0.0 |
| Tamcot | | | | |
| Sphinx | 0.95 | 0.27 | 7.1 | 1.4 |
| Susceptible genotype | 2.12 | 1.29 | 19.3 | 7.6 |

Table 4. Mean lint yield, earliness, boll size, lint percentage and gin turnout of Tamcot Pyramid in comparison with Tamcot Sphinx and Paymaster 330, abstracted from 38 tests over a four year period, 1996-1999.

| Cultivar | Total Yield lb/a | Earliness % | Boll Size no. | Lint percent % | Gin turnout % |
|-------------------------------|-------------------------|--------------------|----------------------|-----------------------|----------------------|
| Tamcot Pyramid | 836 | 63.2 | 82 | 36.6 | 27.6 |
| Tamcot Sphinx | 763 | 63.5 | 92 | 36.1 | 27.4 |
| Paymaster 330 | 763 | 58.9 | 92 | 36.3 | 27.2 |
| Test mean | 787 | 61.9 | 88 | 36.3 | 27.4 |
| LSD ($P=0.05$) ¹ | 63 | 4.2 | 4 | 0.5 | 0.5 |
| C.V. % | 22.3 | 18.1 | 10 | 3.9 | 4.4 |

¹ Least significant difference between two means within a column.

Table 5. Mean yield components of Tamcot Pyramid in comparison with Tamcot Sphinx and Paymaster 330.

| Cultivar | Seed/Boll No. | Seed Index g/100 Seed | Lint Index g/100 Seed | Boll Size g |
|-----------------|----------------------|------------------------------|------------------------------|--------------------|
| Tamcot Pyramid | 31.44 | 10.91 | 7.49 | 5.83 |
| Tamcot Sphinx | 27.40 | 10.76 | 6.90 | 4.93 |
| Paymaster 330 | 31.40 | 11.00 | 6.76 | 5.64 |
| Mean | 30.08 | 10.89 | 7.05 | 5.47 |

Table 6. Mean fiber quality traits of Tamcot Pyramid in comparison with Tamcot Sphinx and Paymaster 330, abstracted from 17 tests over a four year period, 1996-1999.

| Cultivar | Fiber Traits (HVI)¹ | | | | |
|-------------------------------|---------------------------------------|---------------------|-----------------------|---------------------|---------------------------|
| | UHM Length inches | Unifor- mity | Strength g/tex | Elonga- tion | Micro- naire Units |
| Tamcot Pyramid | 1.05 | 83.3 | 28.1 | 5.9 | 4.1 |
| Tamcot Sphinx | 1.08 | 83.5 | 30.2 | 5.6 | 4.4 |
| Paymaster 330 | 1.05 | 83.3 | 29.5 | 6.3 | 4.5 |
| Test mean | 1.07 | 83.4 | 30.0 | 5.9 | 4.3 |
| LSD ($P=0.05$) ² | 0.01 | 0.4 | 0.6 | 0.1 | 0.1 |
| C.V. % | 2.20 | 1.1 | 4.7 | 4.9 | 6.2 |

¹ Fiber analysis performed by the International Textile Center, Texas Tech University, Lubbock, Texas.

² Least significant difference between two means within a column.