

# Field Evaluation of Advanced Breeding Lines for Organic Cotton Production

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## Introduction

- Over 90% of commercial cotton (*Gossypium hirsutum*) acreage in U.S. is planted with genetically-modified (GM) seed.
- Use of GM varieties is forbidden by organic certification guidelines.
- Over 95% of commercial organic cotton acreage in U.S. is located on the Texas High Plains (THP).
- Need for cultivars developed specifically for organic production in that region.
- Development of non-GM cultivars is key for improving production.
- Thrips (Thysanoptera: Thripidae) have been identified as a major arthropod pest by organic cotton producers on the THP.
- Thrips tolerance or resistance would also aid production.
- Need to maintain/improve advantageous agronomic traits (crop maturity, yield, fiber quality, etc.).
- FiberMax<sup>®</sup> FM 958 is one of the most-grown varieties in commercial organic systems—need a greater variety and availability of cultivars to ensure sustained production.
- Objective 1: Evaluate agronomic performance of non-GM lines in certified organic and conventional production systems.**
- Objective 2: Compare individual leaf surface areas among breeding lines to assess possible differences in thrips injury.**

## Materials and Methods

- Location:** Cliff Bingham Farm near Meadow, TX and the Texas AgriLife Research and Extension Center near Lubbock, TX in 2011.
- Experimental Design:** Randomized complete block design (4 blocks) at each location.
- Genotypes Planted:**
  - Meadow** – Eight advanced breeding lines and 2 commercial check varieties (FM 958 and FM 989).
  - Lubbock** – Seven advanced breeding lines and 1 commercial check variety (FM 958).
- Field Management:** Meadow location was managed according to certified organic management guidelines; Lubbock location was managed conventionally (to accommodate crossing activities).
- Sampling Regime:** Leaf samples were collected weekly from all plots at the Meadow location, during typical thrips infestation period for that area. Sampling began June 10 and ended July 6.
- Data Collection:** All leaves were measured for leaf surface area using a LI-COR LI-3100C Leaf Area Meter (LI-COR, Lincoln, NE). Visual estimates of crop maturity and storm resistance were made on Oct. 10. Yield, lint turnout, picked lint, and pulled lint data were also collected for each genotype.



Fig. 1. Two locations of a field evaluation of advanced breeding lines for potential organic production, near Lubbock, TX and Meadow, TX in 2011. Source: Google<sup>™</sup> Earth

## Results



Table 1. Yield and harvest data and maturity and storm rating data for 8 advanced cotton breeding lines and 2 commercial varieties in a certified organic production system near Meadow, TX in 2011.

Genotype	Lint Yield	Lint Turnout	Picked Lint	Pulled Lint	Mature Bolls <sup>a</sup>	Stormproof Rating <sup>b</sup>
	kg ha <sup>-1</sup>	%				
06-21-519FQ	966 a	24.9 ab	35.6 cde	25.2 de	48 abc	5.25 ab
06-45-1104D	995 a	23.0 cd	37.1 bc	27.9 ab	40 bc	5.75 ab
07-7-1001CT	968 a	23.7 bcd	33.8 f	25.0 e	57 ab	5.00 bc
07-7-1407CT	983 a	25.7 a	38.2 ab	27.5 abc	65 a	5.25 ab
07-14-205FS	1124 a	22.3 d	34.3 ef	25.2 e	61 a	5.50 ab
07-14-510FS	1083 a	25.0 ab	37.7 ab	26.8 bcd	65 a	5.25 ab
07-20-1304D	1094 a	22.6 d	36.0 cd	26.1 cde	51 abc	6.00 a
04-WB-33s	1089 a	23.4 bcd	35.2 def	26.0 cde	55 abc	4.25 c
FiberMax <sup>®</sup> FM 958	977 a	24.7 abc	39.2 a	28.8 a	63 a	6.00 a
FiberMax <sup>®</sup> FM 989	1076 a	23.2 bcd	35.5 de	25.4 de	35 c	5.00 bc
LSD <sup>c</sup>	179	1.8	1.5	1.6	20	0.87

Means within a column followed by the same letter are not different at P = 0.05. <sup>a</sup> Visual estimate of mature bolls; <sup>b</sup> values based on 1-9 visual rating scale for storm resistance (1 = poor; 9 = excellent); <sup>c</sup> least significant difference.



Table 2. Yield and harvest data and maturity and storm rating data for 7 advanced cotton breeding lines and 1 commercial variety under conventional management near Lubbock, TX in 2011.

Genotype	Lint Yield	Lint Turnout	Picked Lint	Pulled Lint	Mature Bolls <sup>a</sup>	Stormproof Rating <sup>b</sup>
	kg ha <sup>-1</sup>	%				
06-21-519FQ	626 a	26.2 ab	36.6 b	25.5 bc	43 abc	5.67 a
06-45-1104D	543 a	23.8 c	33.0 c	24.1 c	53 abc	5.00 a
07-7-1001CT	769 a	24.7 bc	34.5 c	25.2 c	58 ab	4.67 a
07-7-1407CT	931 a	27.7 a	39.7 a	29.6 a	38 bc	5.00 a
07-14-205FS	748 a	24.2 c	34.6 c	24.8 c	33 c	5.67 a
07-14-510FS	680 a	26.3 ab	40.2 a	29.1 a	61 a	5.33 a
07-20-1304D	632 a	25.1 bc	36.9 b	26.8 b	50 abc	6.33 a
FiberMax <sup>®</sup> FM 958	650 a	26.9 a	37.0 b	26.8 b	60 a	6.00 a
LSD <sup>c</sup>	442	1.6	1.6	1.5	21	1.6

Means within a column followed by the same letter are not different at P = 0.05. <sup>a</sup> Visual estimate of mature bolls; <sup>b</sup> values based on 1-9 visual rating scale for storm resistance (1 = poor; 9 = excellent); <sup>c</sup> least significant difference.

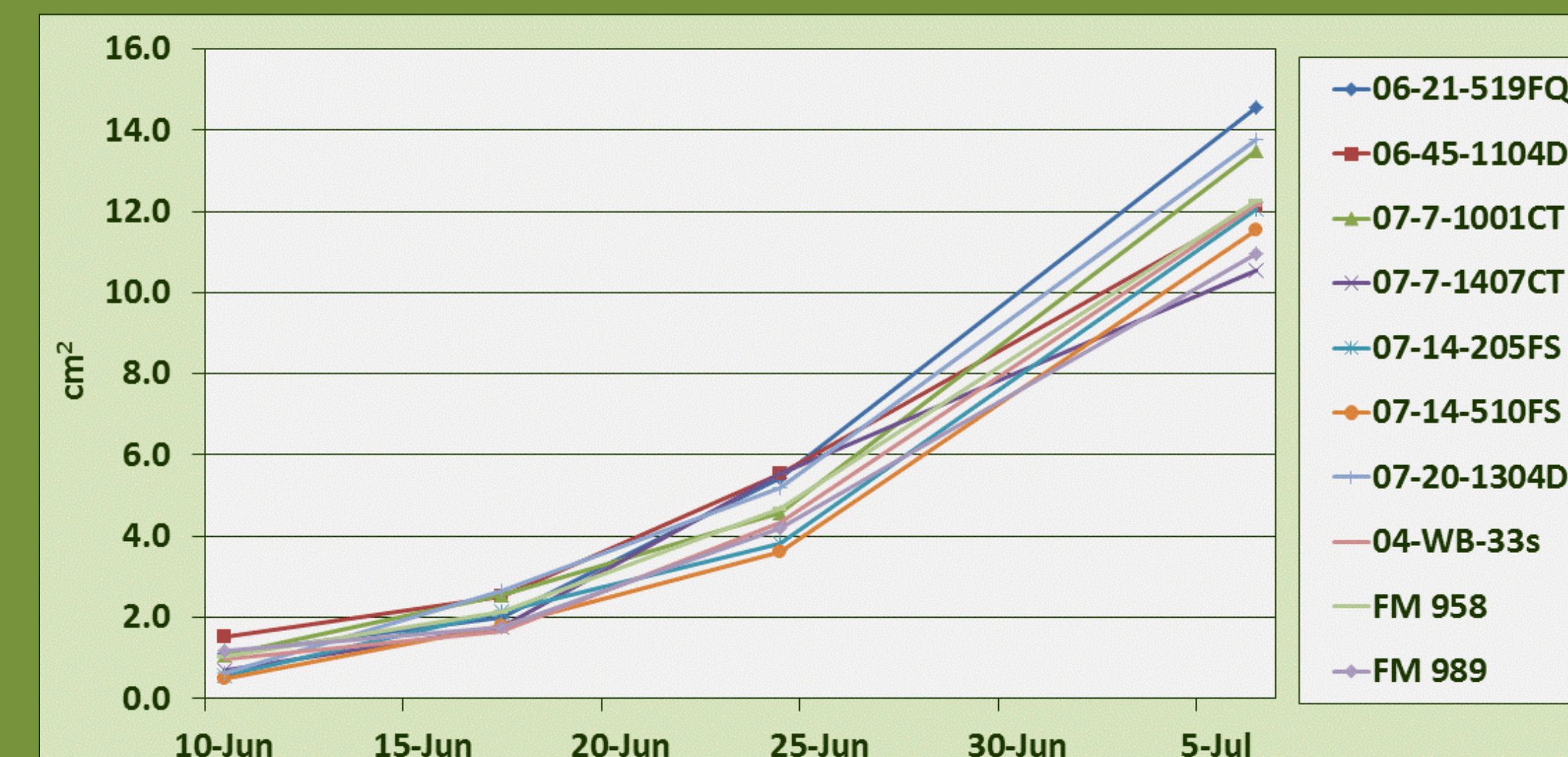


Fig. 2. Mean individual leaf surface area of 8 advanced cotton breeding lines and 2 commercial varieties in a certified organic production system near Meadow, TX in 2011.

## Discussion and Conclusions

- Extreme drought conditions in 2011 growing season – worst single-year drought on record for region.
- Severely limited crop growth at both locations.
- No yield differences among genotypes at either location.
- Lint yields of all breeding lines were comparable with FM 958 under drought conditions.**
- Significant lint turnout, picked lint, pulled lint, and maturity differences among genotypes at both locations.
- 07-7-1407CT and 07-14-510FS lines exhibited excellent combination of harvest traits, maturity, and storm resistance under both organic and conventional management—comparable with FM 958.**
- No differences in individual leaf surface area among genotypes at any sample date.
- No observable thrips feeding injury on any genotypes—lack of pressure as a result of extreme drought conditions.
- No sprayed control available for calculation of leaf area reduction from thrips damage.
- More research needed to observe thrips injury among genotypes under normal growing conditions and thrips pressure.
- Need to include sprayed control to determine leaf area reduction among genotypes.
  - Organically-managed test on non-certified land?*
- Future work:**
  - Greenhouse trials to determine segregation and heritability of thrips resistance trait(s).**
  - Field evaluation of selections from nursery.**
  - Integrated Pest Management (IPM) study for thrips control using combination of resistant genotypes and approved insecticides.**

