

TESTING HIGH YIELD/QUALITY INTERSPECIFIC HYBRID COTTON VARIETIES IN THE SAN JOAQUIN VALLEY

Dan Munk, Jon Wroble, and Shane Ball

University of California Cooperative Extension

Meir Gadisman

Hazera Seeds

Abstract

Testing high yield and high quality cotton varieties is an essential part of any regional cotton evaluation program aimed at improving grower returns and influencing farm agronomic management decisions made. Historic testing of inter- and intra-specific Upland and Pima cotton F1 crosses has produced mixed results particularly with respect to grower adoption and acceptance of these materials for the purpose of establishing widespread plantings. Beginning in 1999 we established tests of inter-specific Pima-Upland hybrid varieties in the San Joaquin Valley (SJV). Initial results included field tests that demonstrated record yields at the West Side Research and Extension Center and HVI testing that recorded encouraging, though mixed, cotton quality results. Continued yield and quality testing expanded in 2000 with multiple large-scale grower tests conducted in the 2001 through 2003 growing season. Trial yield data collected and summarized ranged from no yield benefit of HA195 plantings, when compared to commercially standard Pima and Acala cotton varieties, to lint yield increases of more than one-bale per acre. High yield differentials were consistently observed when field conditions produced significant water and salt stresses, further demonstrating their potential fit for larger scale SJV production.

Introduction

Characterization of hybrid cotton growth and productivity in California's San Joaquin Valley has occurred for many years by both public and private breeding programs with little success of producing marketable varieties having desirable qualities to both growers and the marketplace. Plant material crosses that have been used to increase fiber quality characteristics commonly use Pima or Sea Island cotton types along with an Upland parent to derive a high fiber quality Inter-specific cross. The resulting plant material can retain many of the improved fiber characteristics of the higher quality parent however this commonly occurs at the expense of crop productivity.

Inter-specific hybrid cotton varieties commonly have high vigor characteristics reflected in traits that include exceedingly high plant vigor accompanied by low harvest index values. These traits are problematic for most growers that seek varieties that can be managed with low inputs that include PGR's, irrigation water and crop defoliant. Vigorous growing varieties can also exhibit poor agronomic characteristics that result from delayed fruiting and delayed carbohydrate demand that occur as a result of their small boll size and distribution on the plant.

Successful testing and development of inter-specific hybrid cotton varieties will therefore require additional income be generated to offset any increased management costs as well as the increased seed costs that come from breeding these hybrids. Our objective in these trials was to evaluate hybrid cotton varieties over a multiyear period, to test their productivity and quality against industry standard varieties and to better understand how specific environmental conditions influence hybrid productivity.

Some of the researchable questions that we outlined were applications oriented and aimed at understanding the current or future practical value of unique hybrid properties that could benefit current cotton system goals. Can inter-specific cotton hybrids produce yields comparable or superior to current Acala and Pima standards? Are fiber properties of hybrids desirable in the market? Do hybrids have specific traits that allow them to more effectively tolerate water and salt stress conditions common to many cotton farms in the west?

Materials and Methods

Large and small-scale field evaluations of inter-specific hybrid cotton were conducted beginning in 1999 alongside San Joaquin Valley standard Acala and Pima varieties to assess hybrid variety performance. All studies used randomized complete block design having four replicates in which plant growth, yield and quality data were developed. Initial studies were conducted at the University of California's West Side Research and Extension Center (WSREC) in Five Point's California using four-bed plots running 60 feet. Plots were managed in a manner similar to that desirable of long-season cotton varieties grown in the region and managed for optimum performance on 40 inch cotton beds.

Trials continued at the WSREC in the 2000 through 2002 seasons and were also expanded to include large-scale screening trials in 2001 and 2002 conducted within the California Cotton Board's Pima variety testing program. During these years,

similar large-scale trials were conducted that would help identify variety performance capability on lower yield potential fields having salt affected soils. These replicated trials had plots of 4 or 6 beds running approximately 1300 feet.

Cotton tests conducted in 1999 and 2000 were dominated by Hazera Seeds inter-specific hybrid cotton varieties alongside industry standard Pima S7 and Acala Maxxa with a large scale irrigation and salinity trial was conducted in 2000. Subsequent tests focused more heavily on HA195 though screening activities continued at the WSREC through 2002. The 2001 and 2002 Pima variety tests conducted in the SJV Cotton Board trials included 14 to 15 non-hybrid varieties having a wide range of genetic background represented in addition to HA195.

Results and Discussion

Initial screening trial results obtained in 1999 were very encouraging as we identified two inter-specific hybrid cotton varieties that produced significantly higher yields than both the Pima and Acala standards tested figure 1. Increases in HA195 approaching 400 lb's of lint per acre were observed in this single test with average plot yield topping 2400 lbs. lint per acre; a lint yield record at the WSREC site. We ran both saw and roller ginned sub-samples for turnout and quality and found that lint quality was similar enough to ELS varieties, that there could be more opportunities for price premiums if HA195 was roller ginned in the future.

The 2000 material screening tests continued to find HA195 and 14-08 to have high yield characteristics though the increases in yield above the industry standards was not repeated in this test, figure 2. However yield performance advantages were identified that year when irrigation trials were conducted and water stress induced, figure 3. The irrigation treatment that limited plant available water most clearly outperformed industry standards Acala Maxxa and Pima S7 indicating this variety had unique traits that allowed the cotton to perform under these severely stressed environmental conditions.

Strong relative yield performance was observed in large-scale San Joaquin Valley approved Acala studies conducted in 2000 at a site that contained high surface salt concentrations, figure 4. Surface soil solution extracts measured at the site exceeded cotton threshold values of 7 dS/m in most locations with more than 10 dS/m soils that created a severe yield limiting condition. Similar tests conducted on Approved Pima varieties at a salt affected site found that both HA14-08 and HA195 could perform well above grower available Pima varieties.

Yield performance in the SJV cotton board Pima trials also showed HA195 having very high yield performance characteristics. For instance in 2001 the variety topped the trial at each of the four sites, table 1. Average yields at the four sites were 1705 lbs./ acre. Similarly strong performance was seen in 2002 when overall yields in the SJV were at record levels. Average yield performance at the 4 sites in 2002 was 2069 which compared to 1300 lbs. per acre measured for Pima S7. But the yield performance of HA195 did not always top the trial results evidenced by the 2002 variety test located at the WSREC that found Phy72 out-yielding HA195. This year was a particularly good for Phy72 that yielded 5 bales in numerous SJV fields.

Gin turnout data obtained from these trials shows HA195 having a range of 30 to 35 percent and a seed size similar to the public variety Pima S7, table 2. But though turnout data is similar to Pima S7, fiber characteristics can contrast with the current Pima quality standard.

HVI trial data averaged from six independent trials found a nearly equal number of 44 and 46 staple cotton, whereas Pima S7 rarely had a 44 staple length measured, figure 5. Although micronaire was consistently in the ideal range for ELS cottons, strength measurements were significantly and consistently lower than Pima S7 quality when grown side by side. HA195 had the distinct trend to have lower values of yellowness and often received color grades at or above the standard variety.

Conclusions

Early studies conducted in the San Joaquin Valley indicated two interspecific hybrid cotton varieties that had yields that surpassed current cotton industry standards. Cotton processing data confirmed that roller ginning these hybrids increased quality to a level that improved the growers' ability to enter the ELS cotton market, thereby improving grower returns. Though current quality results show lower fiber quality standards, especially strength, other fiber characteristics are similar to or above the industry standard varieties. This work demonstrated the hybrid varieties that performed best were very tolerant of water and salt stress conditions commonly experienced in the San Joaquin Valley. Continued work should include evaluating varieties with higher fiber quality while maintaining high yields.

Table 1. Yield (lbs. lint/acre) from the San Joaquin Valley Cotton Board trials at 4-locations in 2001.

Variety	4-location Avg.	Buena Vista	Corcoran-North	Corcoran-South	Tulare
HA-195	1705 (1)	1623 (1)	1749 (1)	1689 (1)	1774 (1)
S-7	996 (14)	907 (15)	1174 (6)	803 (14)	1128 (9)

() = Ranking out of 15 varieties

Table 2. Gin turnout data from the San Joaquin Valley Cotton Board trials at 4-locations in 2002.

Variety	4-location Avg.	Buena Vista	Corcoran-South	Corcaoran-West	Huron
HA-195	31.7 (6)	31.5 (4)	31.7 (10)	33.3 (8)	30.1 (4)
S-7	31.5 (9)	31.4 (5)	31.8 (9)	33.4 (7)	29.5 (9)

() = Ranking out of 16 varieties

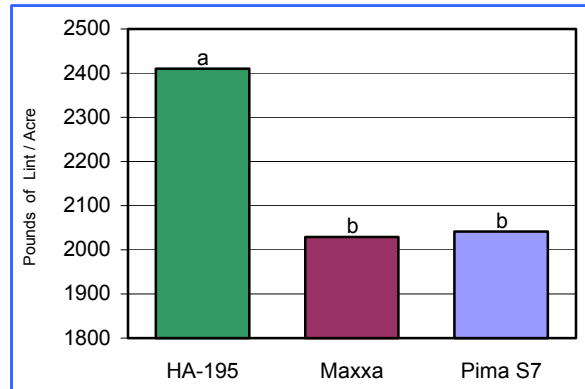


Figure 1. Yields from the Hazera Variety Trial at the UC WSREC in 1999.

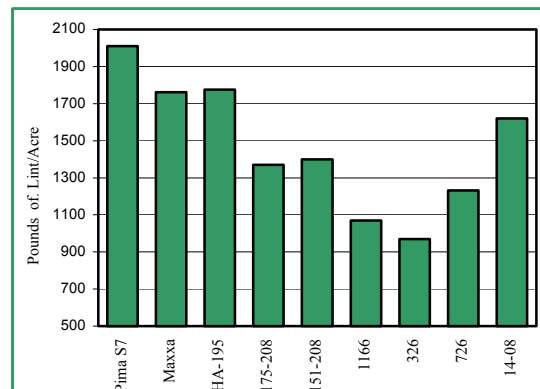


Figure 2. Yields from the Hazera Variety Trial at the UC WSREC in 2000.

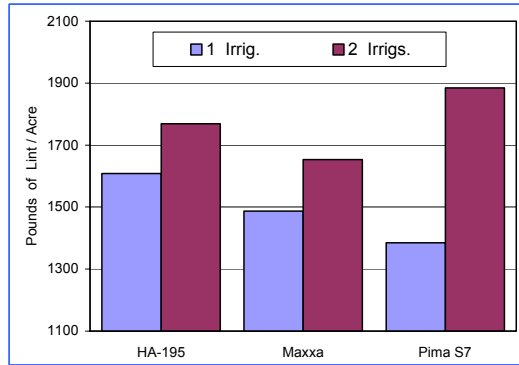


Figure 3. Yield data comparing HA-195 to the standards Maxxa and Pima S7. 2000 Irrigation Trial at the UC WSREC.

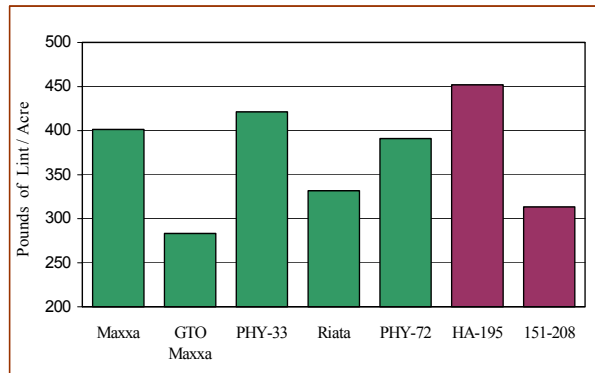


Figure 4. Yields from Approved Acala & Hybrid Variety Trial on salt affected soils in 2000.

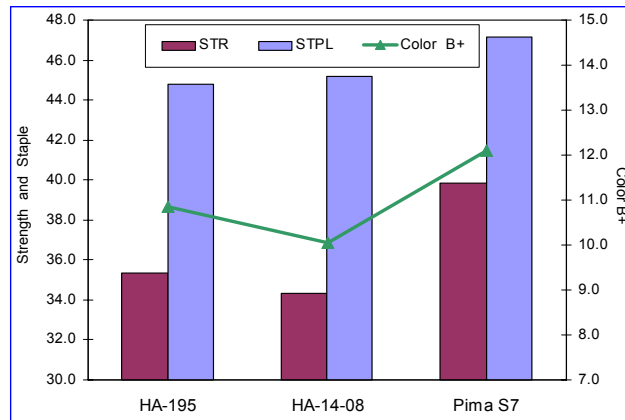


Figure 5. Cotton quality characteristics of HA-195 and HA-1408 in contrast to Pima S7 from six different trials in the San Joaquin Valley.