# GENETIC GAINS IN FIBER QUALITY FROM THE 1900S TO PRESENT IN UPLAND COTTON

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## Abstract

Seventy-three cultivars were selected to represent each decade from the 1900s to the present based on year released. Cultivars also represented four different growing regions within the U.S., consisting of the Southeast, Midsouth, Southwest, and West. These cultivars were planted in Weslaco, TX and Corpus Christi, TX in 2016 with 3 replications. Boll samples were taken and fiber quality determined using High Volume Instrumentation (HVI) and Advanced Fiber Information System (AFIS). ANOVA was conducted for all traits using a general linear model, and LSmeans were used in simple linear regression to calculate gains. If a significant interaction was detected (p-value<0.05), LSmeans were calculated for each location and regressed separately to calculate gains.

Significant positive gains (p-value<0.5) were detected from the 1900s to the present for the HVI measurements of upper half mean length (UHML), uniformity (HVI UNIF), micronaire, and strength. Significant positive gains were detected from the 1900s to the present for HVI measurements upper quartile length by weight (UQL(w)), length by weight (L(w)), length by number (L(n)), maturity, and fineness in millitex. Significant negative gains in short fiber content by weight (SFC(w)), short fiber content by number (SFC(n), length by weight coefficient of variation by weight (L(w) CV%). Gains for length were comparable for length measurements of UHML, UQL(w), L(w), and L(n) ranging from 0.00078 inch/year for L(n) to 0.001 inch/year with UQL(w).

Table 1. Genetic Gains for HVI and AFIS Fiber Quality Traits: Genetic gains, adjusted R squared for simple regression model, and correlation between trait and year is shown for all HVI and AFIS traits for gains since 1900, gains before 1980, and gains after 1980.

| Trait | Gains Since 1900 | $R^2$ | r | Gains Before 1980 | $R^2$ | r | Gains After 1980 | $R^2$ | r |
|---|---|---|---|---|---|---|---|---|---|
| **UHML** | + 0.00092 in/yr | .20 | .46 | + 0.0015 in/yr | .24 | .50 | + 0.0017 in/yr | .19 | .47 |
| **UQL(w)** | + 0.001 in/yr | .21 | .47 | + 0.0017 in/yr | .25 | .52 | + 0.0017 in/yr | .18 | .45 |
| **L(w)** | + 0.0089 in/yr | .24 | .51 | + 0.0014 in/yr | .26 | .53 | + 0.0012 in/yr | .13 | .40 |
| **L(n)** | + 0.00078 in/yr | .26 | .52 | + 0.001 in/yr | .22 | .49 | . | . | . |
| **HVI UNIF** | + 0.01955 %/yr | .27 | .53 | + 0.025 %/yr | .20 | .47 | + 0.022 %/yr | .10 | .36 |
| **SFC(w)** | - 0.013 %/yr | .17 | -.43 | - 0.011 %/yr | .08 | -.32 | . | . | . |
| **SFC(n)** | - 0.17 %/yr | .05 | -.26 | . | . | . | . | . | . |
| **AFIS L(w) CV%** | - 0.011 %/yr | .06 | -.26 | . | . | . | . | . | . |
| **Micronaire** | + 0.0032 units/yr | .06 | .28 | . | . | . | . | . | . |
| **Maturity** | + 0.0005 units/yr | .32 | .57 | + 0.00052 units/yr | .19 | .46 | . | . | . |
| **Fineness** | + 0.087 millitex/yr | .05 | .25 | . | . | . | . | . | . |
| **Strength** | + 0.041 cN/tex/yr | .29 | .54 | + 0.04 cN/tex/yr | .19 | .46 | . | . | . |

Cultivars were then divided into two categories; those released before 1980 and those released after 1980. This date was chosen as HVI began broad use in breeding programs in the 1980s. By the 1990s HVI was incorporated in most breeding programs in the U.S. (Smith and Cothren 1999). Analysis suggested that broad implementation of HVI has not made a major impact in the rate of genetic gains for fiber quality. This could be due to the relatively short time frame; however, it has been noted that development of transgenic cultivars in the mid-1990s from backcrossing to existing cultivars lead to a stagnation in fiber quality improvement (Bowman and Gutierrez 2003). This does not mean

that HVI has not enabled breeders to identify outliers in a breeding program. These data are also an important reminder that there were many measuring techniques and parameters used in selection for fiber quality before the development of HVI.

## References

Bowman D.T., and O.A. Guitierrez. 2003. Sources of fiber strength in the U.S. Upland Cotton Crop from 1980-2000. J. Cotton Sci. 7:164-169.

Cothren (ed.) Cotton: Origin, history, tefchnology, and production. John Wiley & Sons, New York.