2004 BELTWIDE COTTON CONFERENCES, SAN ANTONIO, TX – JANUARY 5-9

DETERMINING GIN VARIABILITY FOR HVI AND AFIS DATA

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Abstract

Fiber length by weight distribution data generated by the advance fiber information system (AFIS) analysis of cotton samples from a generation mean analysis (GMA) in 2001 revealed abnormal and unique curves. Possible sources of variability included the AFIS machine, the laboratory roller gin, day of ginning, and time of day, and of course, the genetics of the segregating F2 plants evaluated. Before the cotton samples of the GMA in 2002 were roller ginned, gin standards were established to monitor roller and saw gin variability. TAM WD-18, a long staple genotype, and TAM 96WD-81, a short staple genotype and both unreleased breeding lines, were selected to serve as the gin standards to be ginned across multiple days and three times each day (morning, noon, and evening). A 100-gram seedcotton sample of each genotype was ginned on a predetermined day and time for the laboratory roller gin and an eight saw laboratory gin. From the 100-gram seedcotton sample, an 8 to 10 gram lint sample was pulled for AFIS analyses and the remaining lint sample evaluated by high volume instrument (HVI). The objective was to investigate if differences exist between roller and saw ginning, day of ginning, and time of day in order to determine if gin standards or controlled environmental conditions are needed to gin samples in plant breeding programs.

The fiber traits selected for comparison were upper-half mean fiber length (UHM) and micronaire (Mic) from HVI and fiber length by weight (Lw), short fiber content by weight (SFCw), fineness (fine), and maturity ratio (MR) from AFIS. The number of ginning days totaled 21, starting on 15 January and ginning on selected days until completed on 3 April in a laboratory where the environmental conditions such as humidity were not controlled. In the analysis of variance, gin, time of day, and genotype were considered fixed effects and day was considered a random effect. In the analysis of variance for the HVI fiber traits, there was a significant gin effect for UHM and Mic. No significant time or gin*time effects were detected. UHM fiber length did have a significant day and genotype effect, while micronaire had a significant genotype*gin and genotype*day interaction. In the analysis of variance for AFIS fiber traits, there was a gin effect ($p < 0.001$) for Lw, Fine, and MR. Time of day did not affect ($p<0.05$) AFIS results but there was a gin*time effect for Lw. Day of ginning affected ($p<0.05$) Lw, SFCw, and MR and there was a significant effect of time*day for SFCw.

Roller ginned samples had longer UHM and Lw fiber length than saw ginned samples. Micronaire decreased from 4.7 on day 1 to 4.45 on day 21 for the long staple genotype. The short-saw and short-roller ginned samples had an average Mic of 4.45 units on day 1, but the short-saw ginned samples increased to 5.0 by day 21 and the short-roller ginned samples increased to 4.7 units. Saw ginned samples had finer fibers than roller ginned samples. Fineness of the long-staple genotype, TAM 96WD-18, increased over the 21 days whereas the short genotype decreased in fineness. Finally, roller ginned samples had a higher maturity ratio than saw ginned samples.

Cross entropy, a method to compare distribution data, revealed no differences between fiber length by weight distribution data between roller and saw ginned samples. Comparing the long-roller and long-saw, the two had a cross entropy value of 52.9 and the short-roller and short-saw distributions had a value of 183.9. A value under 350 is deemed acceptable.

To determine if the variability resulted from the AFIS machine or the gins, the coefficient of variation (CV) was averaged across the International Textile Center (ITC) checks for each day and then averaged across the 21 days. The gin standards coefficients were averaged across the 3 gin-times each day and then averaged across the 21 days. The analysis of variance for coefficient of variation of AFIS fiber traits detected no day effect, but significant standard effect for all four AFIS fiber traits. The ITC checks had significantly higher CVs for Lw, SFCw, and MR, 8.93, 31.50, and 4.91 percent respectfully. The ITC checks had the highest CV value of 4.25%, but were not different from the short-roller CV of 3.48%. Comparing the two gins, the saw gin numerically had lower CVs than the roller gin.

Significant gin effects were detected for UHM, Mic, Lw, fine, and MR. No time effects were observed suggesting that environmental conditions during the day did not impact fiber quality measurements. Significant day effects were found for UHM, Lw, SFCw, and MR. Significant genotype*day effects were detected for all fiber traits except UHM fiber length. No differences in AFIS fiber Lw distributions were detected between roller and saw ginned samples. In summary, the CV% of the ITC checks were significantly higher than all gin standards except short-roller for fineness, suggesting the variability observed is AFIS machine related and therefore gin standards are not needed for these particular laboratory gins.