

IMPROVEMENT OF COTTON (*Gossypium hirsutum* L.) FIBER SPINNING QUALITY THROUGH SELECTION AND INHERITANCE OF FIBER ELONGATION

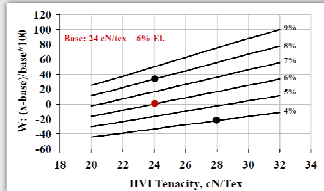
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BACKGROUND



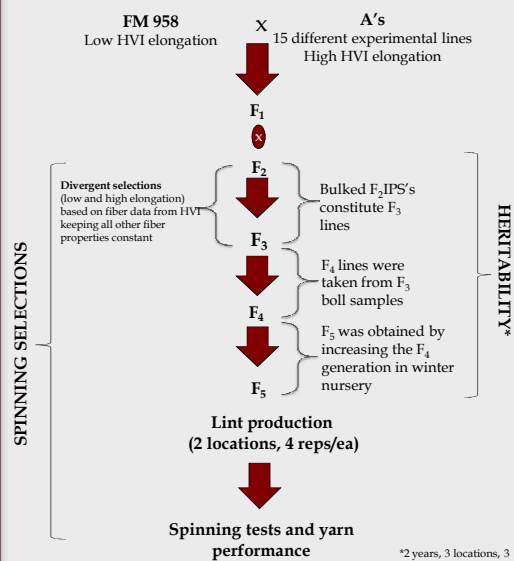
Source, Benzina, et al., 2007

Fiber elongation is as important as strength for yarn quality. A weak negative correlation with strength and poor measurement technology hindered breeding efforts. Could breeders use targeted selection to improve spinning performance?

OBJECTIVES

1. Use divergent selection for fiber elongation to develop lines that isolate the effect of elongation in spinning
2. Determine if cotton fiber bundle and yarn work-to-break can be improved through classical breeding techniques
3. Determine if improving elongation in combination with breaking strength will significantly improve spinning quality of cotton
4. Evaluate and determine heritability of fiber elongation

MATERIALS AND METHODS



RESULTS

FIBER

	F ₂ Elongation (%)	F ₃ Elongation (%)	F ₄ Elongation (%)
Average	9.3	6.12	8.16
Std	0.9	0.79	1.25
CV %	9.7	12.89	15.37
Max	12.8	9.20	11.40
Min	6.9	4.00	6.10

Table 1. Wide range of variation, possibility for divergent selection.

	F ₂ Elongation (%)	F ₃ Elongation (%)	F ₄ Elongation (%)
Strength (g/tex)	-0.320	-0.360	-0.088
Uniformity (%)	0.319	0.004	0.162

Table 2. Negative correlation between HVI strength and elongation is weak, indicating it is possible to improve both properties at the same time.

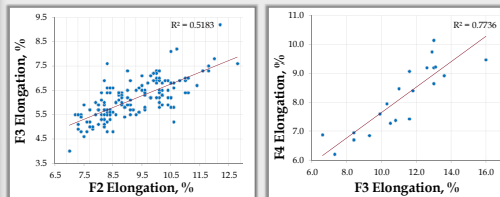


Figure 1,2. Positive significant correlation between generations for elongation indicates progress from selection.

YARN

Entry	Reason	Family	Length (mm)	Uniformity (%)	Strength (g/tex)	Elongation (%)
3	Low	10a	31.68	83.9	37.4	6.3
4	High	10a	28.19	83.4	35.7	8.4
9	High	10b	27.94	82.6	36.3	7.9
10	Low	10b	28.19	82.4	34.8	6.2
11	Low	7	29.21	83.2	34.0	5.6
12	High	7	28.95	83.0	35.9	8.3
19	+E	9	28.70	83.7	38.5	8.4
21	-E	10	32.25	84.3	38.4	5.6
23	Check	FM 958	28.70	82.9	34.6	5.8

Table 3. Nine entries were selected to conduct spinning tests based on divergent elongation and other fiber characteristics.

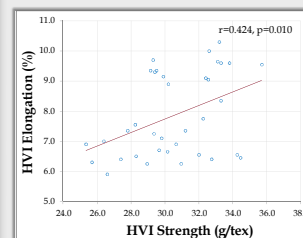


Figure 3. Positive correlation between strength and elongation for the lines selected for spinning tests (last round of selection), indicating that it is possible to improve strength and elongation simultaneously.

YARN (Continued.)

Family	Reason	Entry	Tenacity (cN/tex)	brkelo (%)	work (cN/cm)
9	+E	19	16.96 a	5.48 a	883.91 a
10a	High	4	13.71 d	5.47 a	752.98 b
7	high	12	13.96 cd	5.22 b	732.34 b
10b	High	9	14.44 b	5.17 b	743.89 b
10	-E	21	16.81 a	4.60 c	731.29 b
10a	Low	3	13.53 d	4.26 d	581.00 cd
10b	low	10	14.25 bc	4.22 d	596.54 c
FM958	check	23	13.79 cd	4.02 e	545.41 d
7	low	11	12.28 e	3.83 e	473.69 e

Table 4. Separation mean analysis shows significant differences among entries for yarn tensile properties. Lines selected for high elongation had higher breaking elongation and work-to-break, with 71.5% and 93.3% improvement from low to high elongation respectively.

HERITABILITY: Variance Components

	H ² (%)	H ² (%)	H ² (%)
	F ₂	F ₃	F ₅
Elongation (%)	69.5	56.7	47.9
Strength (g/tex)	73.3	78.0	43.3
Micronaire	77.8	76.5	68.5
Length (mm)	83.2	73.9	74.6
Uniformity (%)	37.7	80.6	72.1

Table 5. Broad sense heritability estimated by the variance component method over years and locations. Around 40%-50% of the observable variance was due to non-genetic effects.

CONCLUSIONS

- * Breeding progress for elongation is indicated by high correlation between F₂ and F₃, and F₃ and F₄
- * It was demonstrated that the weak negative correlation between HVI strength and elongation can be addressed through targeted selection
- * Spinning performance tests suggest that improving fiber elongation improves yarn tensile properties
- * Lines selected for high elongation produced yarn with better tensile properties than the low elongation lines and the check cultivar 'FM958'
- * Heritability from variance components indicated 40-50% of the variation is due to non-genetic effects
- * Results from this project will lay the foundations to breed varieties with improved work-to-break, increased uniformity and reduced short fiber content, resulting in better spinning performance and higher yarn quality

REFERENCE

Benzina, H., E. Hequet, N. Abidi, J. Gannaway, J.Y. Drean, and O. Harzallah. 2007. Using fiber elongation to improve genetic screening in cotton breeding programs. *Textile Research Journal* 77:770-778.