NON-INSECT RELATED STICKY COTTON

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Abstract

On the High Plains of Texas physiological sugars are usually the cause of sticky cotton. Immature cotton fibers killed by a freeze are often sticky. Genetic variations which may influence stickiness exist. Breeding efforts may be an effective course of action to alleviate physiologically derived stickiness.

Introduction

Fibers from cotton (*Gossypium* spp.) can stick in many stages of processing for a variety of reasons. One of the most common causes of stickiness is sugar accumulation. Sugars on cotton fibers are generally from two sources. Honeydew excretions by whiteflies and aphids are the most common sticky sugars worldwide. The other source is physiological sugars directly from the plant. Physiological sugars are the most common cause of stick cotton on the High Plains of Texas.

Cotton fibers which stick during textile processing is a costly problem for the growers, gins, and textile mills. Unfortunately there is no test incorporated into HVI to measure cotton's propensity to be sticky. Even in regions with severe stickiness, most of the crop is not contaminated. Yet the entire crop is labeled as "sticky" (1). It is estimated a cotton crop designated as "sticky" is discounted by 5-10% (1).

Physiological sugar stickiness is not well understood. This type of stickiness is often associated with immature cotton fiber having a low micronaire (4). However, most cotton fiber that is immature with a low micronaire is not sticky. For almost all fiber characteristics there are genetic variations (2, 5). If fiber characteristics can be identified that correlate well to stickiness, then perhaps breeding efforts will be an effective means of reducing physiological sugar stickiness.

Materials and Methods

Field plots were grown at the Texas A&M Agricultural Experiment Station at Lubbock, Texas, during the 1994 and 1995 growing seasons. The six-row plots were in a complete randomized block design with four replications. The twenty cultivars in the test represented a wide range of *G. hirsutum* genotypes.

On August 15,1994, three of the six row plots were treated with Prep ([chloroethyl] phosphonic acid) (72 oz./acre). On August 25,1995, two of the six rows were treated with paraquat (1.5 pint/acre) and two of the six rows were treated with Prep (72 oz./acre). The untreated rows were allowed to be exposed to a killing freeze before harvest.

Plants were hand harvested. Bolls were segregated on the basis of maturity into three groups. The youngest bolls designated as the top crop, the intermediate aged bolls as the middle crop, and the oldest bolls as the bottom crop.

Mechanical and chemical properties were analyzed at the Texas Tech International Center for Textile Research.
The most definitive test was on the carding machine. This test was subjective in nature, but nevertheless an absolute test. Samples were rated on their propensity to stick during the process. A score of 0= not sticky, 1= slightly sticky, 2= moderately sticky, 3= very sticky.

Reducing substances were measured using the Perkins' method (6). Glucose (a reducing sugar) equivalents were reduced by potassium ferricyanide and titrated with cerric sulfate-sulfuric acid and 0-phenanthroline indicator.
Total sugars were measured by treating extracts of the fiber samples with sulfuric acid. The mixture was then measured for its absorption of light. A sugar equivalent was then calculated.

Standard fiber quality data were ascertained. These measurements include micronaire, fineness, % maturity, length, strength, uniformity, elongation, color grades, and leaf trash.

Results and Discussion

The fall weather of 1994 in Lubbock was clear and the cotton suffered little weathering before harvest. The 1995 fall weather produced a four-inch washing rain on September 16. The temperatures were cool and not conducive to the rapid development of fiber. All tests were completed on the 1994 crop within four months after harvest. Physiological sugar stickiness tends to abate in storage (3). At this time only the top crop from 1995 season has been analyzed for % reducing substances (glucose), % total sugars, micronaire, and card rating.

Reducing Substances

In 1994 glucose concentrations were consistently higher from plants treated with Prep than killed by the freeze. There were highly significant differences between genotypes under both treatments and all boll positions. The 1995 top crop cultivars had significant differences under freeze conditions and highly significant differences when treated with Prep. The cultivars treated with paraquat showed no significant differences.

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Total Sugars

Total sugar concentrations in the 1994 crop decreased as the bolls got older. Concentrations were higher in the plants treated with Prep than killed by the freeze. In 1995 the total sugar concentrations were higher in the plants allowed to freeze than in the plants opened by Prep and paraquat. This was likely due to the washing rain in September which occurred between treatment application and harvest.

Micronaire, % Maturity, Fineness

Fiber development followed expected patterns in regard to genome and growth opportunity. The cotton terminated by the freeze and the fiber from the bottom crops was higher in micronaire, % maturity, and fineness. There were high positive correlations among the three traits. In many cases a negative correlation existed among these traits and glucose and total sugar concentrations.

Card Ratings

Samples treated with Prep in 1994 and 1995 as well as paraquat in 1995 showed virtually no stickiness. The top crop killed by the freeze in 1994 was very sticky. The stickiness became milder as the boll position aged. The bottom crop exhibited little stickiness. The 1994 freeze crop had no significant differences among varieties. The 1995 top freeze crop was slightly sticky. There were only slight genetic differences found with an ANOVA p-level of .093887.

Conclusions

Non-insect related stickiness was obtained in this study in 1994 and to a lesser degree in 1995 from the cotton terminated by a freeze. The observed mechanical and chemical properties did show some varietal differences. There appears to be some promise in developing cotton cultivars with a reduced propensity of causing non-insect related stickiness.

References

1. Frydrych, R., Hequet, E., and Brunissen, C. 1995. The high speed stickiness detector: relation with the spinning process. Proceedings of the Beltwide Cotton Conferences. 1185-1189. National Cotton Council, Memphis,TN.

2. Hughs, S.E., and Bragg, C.K. 1995. Some varietal and ginning effects on textile quality. Proceedings of the Beltwide Cotton Conferences. 628-633. National Cotton Council, Memphis, TN.

3. Lalor, W.F. 1992. Sticky cotton; what causes it and how do we deal with it? Proceedings of the Beltwide Cotton Conferences. 547. National Cotton Council, Memphis, TN.

4. Perkins, H.H. 1991. Cotton stickiness - a major problem in modern textile processing. Proceedings of the Beltwide Cotton Conferences. 523-524. National Cotton Council, Memphis,TN.

5. Thaker, V.S., Saroop, S., Vaishnav, P.P. and Singh, Y.D. 1989. Genotypic variations and influence of diurnal temperature on cotton fibre development. Field Crops Research. 22:129-141.

6. Wyatt, B.G. 1995. Personal communication.

Table 1. Correlations of combined crops from 1994.

	Prep	Freeze
% Glucose vs.		
% Total Sugar	.69	.64
Micronaire	-.68	-.35
Card Rating	-	.64
% Maturity	-.62	-.39
Fineness	-.63	-.28
% Total Sugar vs.		
Micronaire	-.47	-.21
Card Rating	-	.53
% Maturity	-.38	-.29
Fineness	-.47	-.14
Micronaire vs.		
Card Rating	-	-.29
% Maturity	.87	.73
Fineness	.95	.96
Card Rating vs.		
% Maturity	-	-.39
Fineness	-	-.20
% Maturity vs.		
Fineness	.69	.50

Table 2. Correlations of 1995 top crops.

	Prep	Paraquat	Freeze
% Glucose vs.			
% Total Sugar	.25	.06	.49
Micronaire	-.27	-.35	-.09
Card Rating	-	-	.21
% Total Sugar vs.			
Micronaire	-.01	-.13	.23
Card Rating	-	-	.23
Micronaire vs.			
Card Rating	-	-	-.06

Table 3. Duncan's Multiple Range test at the 5% significance level. % Glucose of 1994 top crop - Prep and freeze.

Prep		Freeze	
Variety	Mean	Variety	Mean
Stroman 254	1.207 A	TAMCOT HQ-95	.697 A
Deltapine 90	1.140 AB	TAMCOT CAB-CS	.662 AB
Acala 1517-88	1.129 AB	Ysleta Compact	.631 ABC
CA-3076	1.080 AB	McNair 235	.624 ABC
Stovepipe	1.068 AB	Stroman 254	.611 BC
All-Tex Atlas	1.006 ABC	Paymaster 145	.569 CD
Paymaster HS-26	1.004 ABC	Lankart LX-571	.566 CD
Lankart LX-571	.938 ABCD	CA-3050	.534 DE
BS&D Tejas	.900 ABCDE	CA-3084	.525 DE
Ysleta Compact	.877 BCDE	Acala 1517-88	.518 DE
MD-51ne	.866 BCDE	Deltapine 90	.516 DE
McNair 235	.805 CDE	CA-3066	.506 DE
CA-3066	.786 CDE	CA-3076	.505 DE
CA-3050	.726 CDE	Paymaster HS-26	.497 DE
TAMCOT CAB-CS	.742 CDE	Stovepipe	.490 DE
Paymaster 145	.698 CDE	G-1	.471 E
CA-3084	.640 DE	All-Tex Atlas	.468 E
G-1	.617 E	G-2	.457 E
G-2	.615 E	BS&D Tejas	.456 E
TAMCOT HQ-95	.589 E	MD-51ne	.378 F