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CONFERENCE ON EVALUATION OF COTTON BY HVI The March 21 conference on the use of high volume instruments for evaluating cotton that we mentioned in previous issues of *Textile Topics* was attended by approximately 185 persons. These came from the Lubbock area, from many areas across the U. S. cotton belt, and from a few overseas locations. As might be expected, most cotton producers expressed interest in what can be gained by having their cotton evaluated by instruments. A number of questions were asked about cotton fiber strength as obtained by HVI systems and how this measurement may lead to higher prices for their product.

The opening speaker, Jesse F. Moore, Director of the USDA-AMS Cotton Division, reported that in addition to high volume instrument classing already conducted in Lamesa and Lubbock, Texas and Altus, Oklahoma, plans are for the offices in Harlingen, Corpus Christi, Waco, Abilene and El Paso, Texas to begin using HVI systems with the 1983 crop. This does not mean that all cotton in these areas will be HVI classed, but instruments will be used when requested by producers.

Considerable interest was shown in the presentations made by representatives of three textile manufacturing firms. These speakers were John R. Martin of Burlington Industries, Chessley B. Howard of The Graniteville Company and Robert L. Hale of the American Cotton Growers Textile Division. Questions to these speakers dealt with the emphasis placed by some textile companies on the results of instrument testing, whether manufacturers are using HVI results to identify better qualities of cotton, and whether spinners and weavers are interested in having HVI results prior to the purchase of cotton.

The conference was concluded by Vern Highley, Administrator, USDA Agricultural Marketing Service, Washington, D. C. Mr. Highley emphasized the Department of Agriculture's desire to maintain a strong cotton economy. Also, he stressed the importance of having the various sectors of the cotton industry work together on new developments such as high volume instrument classing.

Several of our readers have inquired about the availability of printed copies of the various speeches or a transcript of the entire conference. In response, we need to state that the speakers were not required to submit written papers prior to the conference, and we have no way of passing on a report of the proceedings.

EFFECT OF MOISTURE ON COTTON STRENGTH Those who work with cotton have long realized that it is a hygroscopic fiber. It absorbs moisture from the atmosphere or releases it whenever necessary to adjust to surrounding conditions. The amount of moisture absorbed depends upon a number of factors such as the density of the cotton package (or sample), the rate of air flow through it, and length of exposure to the atmosphere. With the increasing use of high volume instruments for evaluating the physical properties of cotton, interest in the effects of moisture on test results has increased. Particular attention is being given to the influence of moisture on the strength of cotton, and we feel it appropriate to carry information in this issue of *Textile Topics* that might be of value to our readers.

The fiber testing laboratories at the Textile Research Center, and most others we know of in the United States, use standard conditions that have been developed and published by the American Society for Testing and Materials (ASTM). These are a temperature of 70°F ± 2° and relative humidity of 65% ±2%. If the sample is permitted to condition at the proper temperature and humidity levels until equilibrium is attained, the results of testing should be uniform between laboratories and from one time to another, although it must be remembered that some variation in fiber properties exists in the cotton sample itself, regardless of atmospheric conditions. Whenever conditions are changed, however, a corresponding change can be expected in test results.

As we have indicated in earlier issues of *Topics*, high volume instrument testing gives a strength measurement expressed in grams/tex. Cotton producers, marketing firms and the textile industry have all shown interest in this, for it has been found that this measurement correlates well with the strength of resulting yarns and fabrics. If relative humidity in the testing laboratory is not at the standard level but is appreciably lower or higher, the strength measurement will be affected accordingly. It can be seen that if a marketing firm or textile company is paying a bonus for strong cotton, it would like for the measurement to be conducted at proper atmospheric conditions and the results to be accurate.

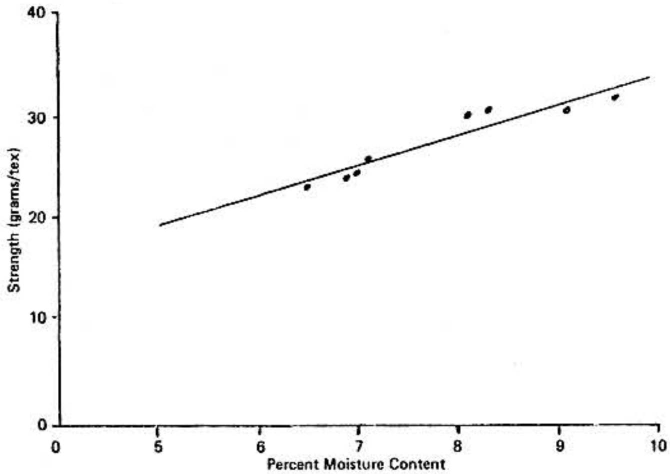
For example, the cutoff point for paying a premium price for strength seems to be 25 grams/tex. A cotton that is borderline might be measured at 24 grams/tex if the relative humidity is low, and no bonus would be paid for it. On the other hand, the proper relative humidity, or higher than normal humidity, would likely show this borderline cotton to be 25 grams/tex or more. The point is that the level of relative humidity will affect measured fiber strength, which in some cases would mean a higher or lower price for a given cotton. It can be seen rather quickly, therefore, that proper atmospheric conditions at testing are important.

Additional research on the effects of moisture and temperature on the measurement of cotton fiber properties is underway at the Textile Research Center, and we understand at least one other institution is investigating the same thing. However, these programs have not been completed, and it would be inappropriate to attempt publishing preliminary results. In view of this, we have gone back in our files and have studied the results of some investigations that were done a number of years ago. With permission from the authors and the organizations responsible for the research, we would like to quote parts of the reports coming from their work.

From a 1976 study that was conducted by Joel Hembree, formerly with the Plains Cotton Cooperative Association, we present the following:

"Moisture content plays a more important part in fiber strength measured in grams/tex than is usually considered to be the case. In this experiment, fourteen samples were tested at eight different levels of moisture content. The lowest level was 6.5 percent and the highest 9.6 percent. These figures are the average for the fourteen bales. The data are shown below:

Moisture (Percent)	Strength (grams/tex)	Bales Tested
6.5	23.6	14
6.9	24.1	14
7.0	24.7	14
7.1	26.3	14
8.1	30.4	14
8.3	30.7	14
9.1	30.7	14
9.6	32.0	14



Moisture Content of the Cotton Fiber and Strength in grams/tex

"The coefficient of correlation was found to be 0.94 which gives a coefficient of determination of 89 percent. This means that 89 percent of the variability in fiber strength was associated with the variation in moisture content of the fiber. These data indicate that a change in moisture content (in the sample) of 1 percent is accompanied by a change in grams/tex of 2.9. The error of estimate is 1.2 grams which is a coefficient of variation of 4.4 percent and this is a reasonable figure. The attached chart (above) shows the nature of the relationship.

"These data indicate that moisture content is critical in any duplication of an earlier test. Unless the same moisture content level is used there will be variation from the original test level. This statement does not consider the variation that may come from the nature of the fiber distribution inherent in a bale of cotton.

"Consequently the effect may not be noticeable for a single test but becomes evident when an average is made of several tests. Although the conclusion cannot be drawn from the data shown, there seems to be an implication that the relationship between moisture content and strength may resemble a Gompertz curve."

From an earlier study that was reported in 1955 by the Cotton Research Committee of Texas (now the Natural Fibers & Food Protein Commission of Texas), we are reproducing the following information. This was done when cotton fiber strength was expressed in thousands of pounds per square inch, as measured by the Pressley tester at zero gauge. However, the report still shows the effects of moisture on strength.

"Mature cotton fibers have a cellulose content of 88 to 96 percent of the dry weight. The cellulose content is affected by varietial characteristics and environmental conditions, especially conditions that retard fiber development such as drouth, disease and early frost.

"Cellulose of the cotton fiber is made up of many glucose anhydride units arranged in a thread-like chain in the molecule. These straight chains are more or less parallel to each other and are formed in the cell wall parallel to the protoplasmic surface. There is an overlapping of the chains. In many areas of the wall, groups of chains may be parallel to each other. Such groups of parallel chains behave as minute crystals and are called crystallites. All of the chains, however, are not parallel. When the molecules are spaced beyond the effective distance, the molecules have an amorphous or unorganized charasteric. A single chain may pass from an area of crystallinity to an area amorphous in nature.

"Of the total cellulose content in dried cotton fibers 85 to 90 percent is of the crystallite type. The primary or outer cell wall contains mostly amorphous cellulose and only a very little crystalline cellulose. The central layers of the secondary cell wall account for about 90 percent of the weight of fibers of average maturity. Mature fibers contain a greater proportion of crystalline cellulose than immature fibers.

"Amorphous cellulose is more hygroscopic in nature than crystalline cellulose. This type of cellulose is responsive to surrounding atmospheric conditions and will absorb or adsorb moisture from the atmosphere in adjusting to prevailing conditions. Crystalline cellulose is far less responsive to atmospheric conditions because moisture does not penetrate a crystalline type formation as readily as an amorphous type.

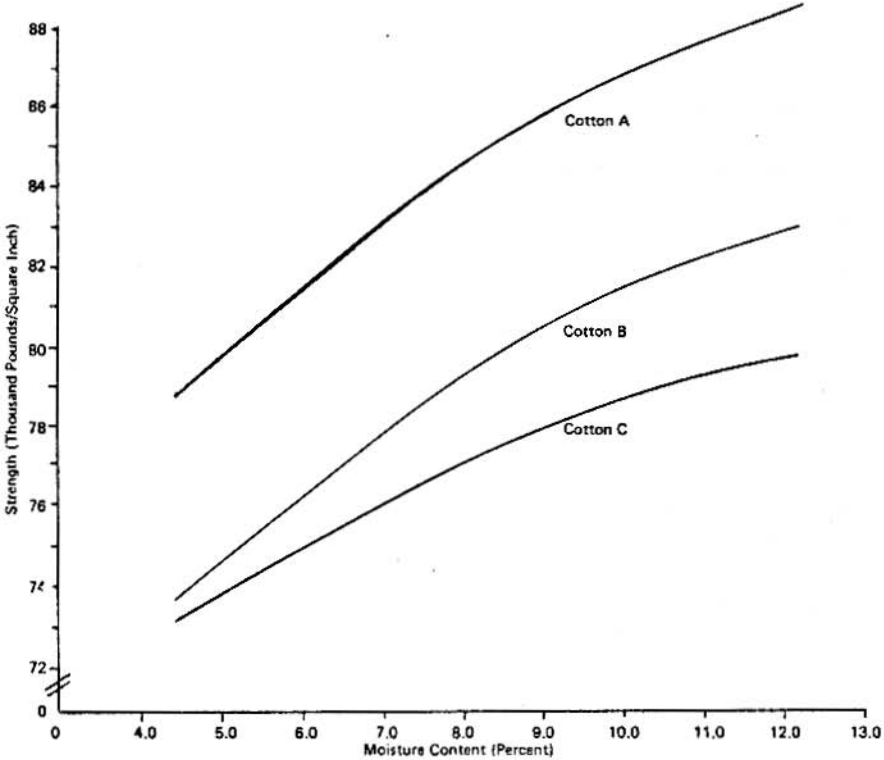
"Moisture in cotton may be expressed in terms of percentage regain or content. The percent of moisture regain is determined by measuring the loss in weight when a sample is dried free of any moisture.

"A hysteresis effect is apparent in the absorption and adsorption of moisture by cotton fibers. When two samples of the same cotton, one bone-dry and the other saturated with water, are conditioned in an atmosphere of the same relative humidity and temperature, the dry sample will have a regain value considerably below the saturated sample. It is important to condition cotton from the dry side to obtain an accurate value of moisture for given atmospheric conditions. A minimum of four hours is required to condition cotton fibers to a given level of atmospheric conditions.

"The U. S. Department of Agriculture conducted a study (1953) to determine the effects of atmospheric conditions on testing certain fiber properties. Tests were made under controlled laboratory conditions using a constant temperature with varying percentages of relative humidity and also with a constant percentage of relative humidity and varying temperature. Samples of cotton were conditioned to different levels of relative humidity and temperature and the fiber properties were determined.

"Strength increased with an increase in moisture content. When relative humidity was increased from 28% to 85% at 70°F temperature, fiber strength for cotton C increased from 73,100 to 78,900 pounds per square inch. The strength of cotton B increased from 73,600 to 81,600 and cotton A from 78,600 to 87,000 pounds." (The effect of percent moisture content on fiber strength is shown in the graph on the following page.)

While repeated testing has shown that HVI systems are accurate and give reliable results, it is ob-



Fiber Strength at Specified Percentages of Moisture Content

vious that prevailing atmospheric conditions during testing can influence the values obtained. It is important, therefore, that HVI cotton classing and evaluation in all laboratories be conducted at standard temperature and relative humidity levels.

We wish to thank Joel Hembree, the Plains Cotton Cooperative Association, and the Natural Fibers & Food Protein Commission of Texas for permitting us to reproduce information they prepared and published previously.

VISITORS We were pleased to have a number of visitors during March. Among those coming to the Center were Charles E. Huffman, Waco, TX; Frances E. Szencan, Albuquerque, NM; Wolfgang Strahl, Cotton Incorporated, Raleigh, NC; Annette van Aardt, Potchefstroom, South Africa, Stella L. Mumme, Houston, TX; Carl Cox, Natural Fibers & Food Protein Commission of Texas, Dallas, TX; Donovan Phipps, Motion Control, Inc., Welch, TX; Barbara Shaeffer and Larry Teague, Motion Control, Inc., Dallas, TX; and Ed White, Spinlab, Knoxville, TN.

Other visitors were John Martin, Burlington Industries, Greensboro, NC; Clarence Rogers, Clemson University, Clemson, SC; John T. Moss, Ring-Around Products, Inc., Dallas, TX; Levon Ray, Ring-Around Products, Inc., Hale Center, TX; Marshall Formby and Graddy Tunnell, LaFont, Tunnell, Formby & Hamilton, Plainview, TX; John Anderson, Hale County State Bank, Plainview, TX; Richard Sawicki, Johnson & Johnson, Sherman, TX; and Hugh Wyn Griffith, Shirley Developments Ltd., Manchester, England.