

TECHNICAL BULLETIN



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TRI 4007

THE MEASUREMENT OF COTTON'S COMFORT

INTRODUCTION

Some years ago, trials were conducted under controlled laboratory conditions to try to measure what consumers around the world perceive: “Cotton is more comfortable.” Many laboratory tests are assumed to be related to comfort, especially those measuring moisture transport and heat insulation. However, at that time, there was few data available on how people perceived differences in comfort of clothing made from different materials.

This is a summary of those pioneering studies of the comfort of cotton. They did indeed confirm that:

The more cotton (versus polyester) a garment contains, the more comfortable it feels.

The only prerequisite was that the testing be done under conditions that promoted mild sweating, as is experienced frequently in everyday life.

References to the original reports are attached.

EARLY TRIALS

Garment wear trials were conducted to define suitable protocols for producing perceivable changes in comfort.

Subjects wearing test garments (formal shirts, to begin with) were first required to exercise before entering a chamber in which the humidity and temperature could be carefully controlled and varied.¹ At intervals, the subjects were asked to describe their sensations of discomfort. Although the test subjects used many terms to describe these sensations, a few terms were widely used by the whole subject group and adopted as standard “descriptors” in later studies. Among the most frequently used terms were “clammy,” “sticky,” and “prickly.”

It became clear that changes in comfort are more obvious when exercise (sweating) is incorporated into the test procedure, followed by controlled, rapid climate changes. The sensations of discomfort diminish over time as the body adjusts to the environment.

The protocol adopted for further tests therefore involved the subjects exercising lightly before entering the controlled atmosphere chamber where, at intervals, they were asked to rate their degree of discomfort using the chosen “descriptors.”

¹ Hollies, N. R. S. Comfort Comparisons of Cotton and Cotton/Polyester Dress Shirts on 100 Men, Final Report, Project CI 71-537, Cotton incorporated, Raleigh, NC, 1975.

MEN'S WOVEN SHIRTS

In this study, one hundred men wore formal shirts made of 100% cotton, 67%/33% cotton/polyester, and 33%/67% cotton/polyester in a random, unknown order. Comfort was evaluated under mild sweating conditions.

When little sweating was apparent near the end of each test, the different shirts felt equally comfortable. At the highest levels of temperature and humidity (95°F and 68% relative humidity), the participants were most uncomfortable. Under these conditions, all participants preferred 100% cotton shirts to blends of cotton with polyester at the 90% confidence level. Half of the subjects could sense a difference between cotton and polyester at the 99.5% level. Generally, one of the 100% cotton shirts was ranked first in preference, and the blend of 33%/67% cotton/polyester was most uncomfortable. Analysis of variance differences that were significant at the 99% level showed that more cotton in the shirt provided higher comfort ratings.

KNITTED SHIRTS

Additional investigations compared 100% cotton men's knit shirts with 50%/50% cotton/polyester and 100% polyester sport shirts.² A 70%/30% cotton/polyester (NATURAL BLEND[®]) shirt was also included in the second part of the work.

The 100% polyester shirt was least comfortable in these two knit shirt studies as judged by rankings, paired garment t-tests, and analysis of variance. The 100% cotton garments were widely preferred over the polyester shirt at the 99% confidence level. Cotton/polyester blends were also chosen at the 99% level over polyester.

OTHER STUDIES

The studies were later extended to other products. Some examples are listed below.

Cotton shirts treated with a fire-retardant finish were generally considered more comfortable at the 95% confidence level than Nomex[®] shirts for wear by firefighters.³

Jeans made from 65%/35% cotton/polyester were ranked less comfortable than two 100% cotton jeans in a study with men and women. Differences between the two cotton fabrics were small.⁴

In a study of women's knit blouses, cotton garments were consistently rated better in tactile and moisture sensations (e.g., less "scratchy" and less "non-absorbent") than garments made from

² Hollies, N. R. S., Koval, D., Hall, P., Dooley, M. Comfort Comparisons of Cotton, Cotton/Polyester and Polyester Sport Shirts on Men, Final Report CI 75-304, Cotton Incorporated, Raleigh, NC, 1975.

³ Hollies, N. R. S., Custer, A. G., Morin, C. J., Howard, M. E. A Human Perception Analysis Approach to Clothing Comfort, *Textile Research Journal*, **49** (10), 557-564, 1979.

⁴ Ibid.

polyester fibers, even those which have specially engineered cross-sections.⁵ Polyester fibers have difficulty achieving good ratings in tactile and moisture areas (i.e., comfort descriptors), whereas cotton can be comfortable for both areas.

A LABORATORY SCREENING TEST

Comfort has been related to the presence of moisture at the inner surface of the fabric and the contact between this surface and the skin. The moisture content of knit shirts similar to those referred to above was measured over a time interval and in conditions identical to the comfort wearing test protocol.⁶ Dynamic surface wetness measurements have shown that the moisture level on the skin-side of a cotton-containing garment changes very slowly at the beginning of exposure. By the time moisture is detected on the cotton fabric, a similar polyester fabric has reached 80% of its equilibrium value. Cotton takes two to three times as long as polyester to reach this saturation point. Cotton/polyester blends behave in a manner similar to cotton, although the moisture values are between those obtained for cotton and for polyester alone.

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⁵ DeMartino, R. N., Yoon, H. N., Buckley, A., et al. Improved Comfort Polyester, Part III: Wearer Trials, *Textile Research Journal*, 54 (7), 447-458, 1985.

⁶ Scheurell, D. M., Spivak, S. M., Hollies, N. R. S. Dynamic Surface Wetness of Fabrics in Relation to Clothing Comfort, *Textile Research Journal*, 55 (7), 394-399, 1985.

RESEARCH AND TECHNICAL SERVICES

Cotton Incorporated is a research and promotion company representing cotton worldwide. Through research and technical services, our company has the capability to develop, evaluate, and then commercialize the latest technology to benefit cotton.

- Agricultural research leads to improved agronomic practices, pest control, and fiber variants with properties required by the most modern textile processes and consumer preferences. Ginning development provides efficient and effective machines for preservation of fiber characteristics. Cottonseed value is enhanced with biotechnology research to improve nutritional qualities and expand the animal food market.
- Research in fiber quality leads to improved fiber testing methodology and seasonal fiber analyses to bring better value both to growers and then mill customers.
- Computerized fiber management techniques result from in-depth fiber processing research.
- Product Development and Implementation operates programs leading to the commercialization of new finishes and improved energy and water conserving dyeing and finishing systems. New cotton fabrics are engineered -- wovens, circular knits, warp knits, and nonwovens -- that meet today's standards for performance.
- Technology Implementation provides comprehensive and customized professional assistance to the cotton industry and its customers -- textile mills and manufacturers.
- A fiber-to-yarn pilot spinning center allows full exploration of alternative methods of producing yarn for various products from cotton with specific fiber profiles.
- The Company operates its own dyeing and finishing laboratory, knitting laboratory, and a laboratory for physical testing of yarn, fabric, and fiber properties including High Volume Instrument testing capable of measuring micronaire, staple length, strength, uniformity, color, and trash content.

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