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The Effects of Wear on Wool Fabrics

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Research workers in the home economics divisions at the South Dakota and Minnesota Agricultural Experiment Stations have cooperated for several years in studying fabrics under actual wearing conditions. The present study in which these tests were made was an experiment to find out which of three weights of wool serge would stand up best under ordinary wearing conditions.

Following are definitions of some of the terms used in describing the results of the tests:

**Warp**—The yarn or thread running lengthwise of a woven fabric.

**Filling**—The yarn running from selvage to selvage at right angles to the warp in a woven fabric.

**Elongation**—The amount of stretching the material can stand before it ruptures. This is usually expressed as a per cent of the original length.

**Breaking Strength**—Often called tensile strength. This is a measurement in pounds of the amount of strain or pull required to break the fabric.

**Bursting Strength**—The amount of pressure necessary to burst one square inch of the material.

**Yarn Strength**—A measure of the force required to break a single yarn or thread removed from the fabric.
The Effect of Wear on Wool Fabrics

Lillian O. Lund, Ethel L. Phelps, Helen Norton and Barbara Miller

“Will it wear?”

This is a question commonly asked by the customer when confronted with a great many bolts of fabric of numerous patterns and weights. When the clothing budget is limited it is especially important that one choose a fabric that will give the most service.

Often the customer wants to know, “Will the heavier material wear longer than the lightweight material?” Unfortunately, no one has found a way to answer these questions definitely by laboratory tests alone.

The term “wear,” as used by the consumer, is a broad term. Not only is wear itself a part of the picture, but dry cleaning, aging, exposure to light, and any other treatment the garment must stand have something to do with how long it will last.

All the “extra” treatment a garment receives, such as bending, rubbing, and creasing, makes it difficult to reproduce in the laboratory the actual effects of wear. So in order to study the wearing qualities of one type of fabric, 27 pairs of trousers were made from an all-wool material of three different weights.

Nine pairs of trousers were made from each weight of material. This allowed three pairs for each wear period, thus avoiding the undue influence of one person’s wearing habits on the test.

The trousers were worn by men students at South Dakota State College for one, two and three periods, each wear period being 1500 hours. This means that three pairs of each weight were worn 1500 hours, three pairs worn 3000 hours and three pairs, 4500 hours. The trousers were dry cleaned and inspected after every 300 hours of wear.

Lengths of the same material were set aside as “control” fabrics. This material was not worn, of course, but was paired with the trousers and received the same amount of dry cleaning and aging as the worn garments. Another set of pieces was stored for a corresponding period without cleaning. By checking the fabric measurements of these samples against those of the worn trousers, it was possible to discover the separate and combined effects of wear, of dry cleaning and of aging.

When the Material Was New

The material used in this experiment was an all-wool serge. This staple worsted fabric is essentially the same basic material which, when modified by herringbone or contrasting stripes or by small plaid effects, is called suiting.

Wool suitings are generally designated by weight in ounces per linear yard. The fabric weights chosen for this experiment were 12 ounces, 14 ounces and 16 ounces per linear yard because these are the weights commonly selected by men for ordinary use.

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The color, construction of fabric and quality of wool were the same for the three fabrics. To all appearances, the materials were alike except for differences in weight. Laboratory measurements showed that the heavier the material, the thicker it was. One might expect that the three fabrics would show corresponding differences in strength and elongation, but these values were nearly the same for the 14-ounce and 16-ounce material. They were much lower for the 12-ounce fabric.

How Wear Changed the Material

At the end of each wear period, research workers cut the worn trousers into samples, tested them in the Minnesota laboratory and observed the changes in the fabric. Most of these changes were small during the first wear period, but by the end of the third period all three weights of serge were lighter and thinner than at the beginning. Even then the 14-ounce and 16-ounce materials were as thick as the 12-ounce fabric when new. All the fabrics lost a great deal of their elasticity due to long use, an important and fundamental characteristic of wool materials.

![Diagram showing breaking strength in pounds for new and worn fabrics, warpwise and fillingwise.](image)

Breaking strength of new and worn fabrics, warpwise and fillingwise, as revealed by experiments conducted at the South Dakota and Minnesota Agricultural Experiment Stations.

The strength of a fabric is important where serviceability is concerned. Tensile or breaking strength is the term used to designate the force required to break a fabric. Since woven fabrics have two sets of yarns, breaking strength must be measured in both warp and filling directions. These two measurements are rarely
the same. The diagram shows the breaking strengths of these materials when new and after each period of wear.

It is obvious that with continuing wear, the strength left in fabrics becomes less and less. The loss of strength is not equal for each period. This difference is most noticeable in the 16-ounce material. If one had assumed, at the end of the second wear period, that the material would keep losing strength at the same rate as during the first two periods, one would naturally expect the 16-ounce serge to wear far longer than the other two weights of material. But the 16-ounce material lost so much strength during the last wear period that its strength in pounds at the end of the tests was little more than that of the 14-ounce.

Bursting strength and yarn strength followed the same pattern.

Effect of Dry Cleaning and Aging

Some of the materials, you will recall, were put aside as "control" fabrics and were not worn, but were dry cleaned as often as the trousers. Other materials were stored only. Checking the results for these against that of the worn trousers showed that dry cleaning, aging, or storage, would have little effect on the measurable properties of these wool fabrics. As one might expect, repeated dry cleaning over a long period of time could cause small losses and small gains in these fabric properties. One must recognize, however, that wear alone and the way the garment is treated represent the major cause of that breakdown which finally results in the cloth wearing out.

How Does Light Affect Wool?

The effect of light begins while wool is still on the back of the sheep, and continues as long as the fabric is worn. Outer garments, of course, are exposed to sunlight, to a varying degree. If exposed long enough to direct sunlight, wool fiber will weaken and become brittle and more sensitive to alkalis.

Since this exposure to light could be one factor influencing the serviceability of these materials, samples of new fabrics were placed in a light similar to sunlight. After 200 hours of such exposure, all fabrics showed decided decreases in strength. After 680 hours under the light, these new materials had lost 60 per cent of their original strength.

Although no record could be kept of the number of hours the trousers were exposed to sunlight, it is evident that light does weaken fabrics. So it does not seem wise to expose wool clothing unnecessarily to direct sunlight.

The First Signs of Wear

Friction, a part of the ordinary wear on clothing, polishes the "hard" surface of wool fibers in worsted fabrics. This is what produces that unwelcome shine that takes the look of newness off the garment. When this shine appears, however, the clothes are far from worn out. Threadbare and worn buttonholes, holes in the seat area, frayed and worn pocket edges, and holes and fraying at the turn of the cuffs are more accurate evidences of wear. These appeared after the garment had given long service. They showed up more and more often in the order given, according to the inspection record for the experimental trousers.
During the first 1500-hour wear period, the trousers showed only a few of these visual effects of wear. During the second period, they increased as the trousers lost strength, thickness, weight and "stretchability." By the end of the experiment—4500 hours of wear—the trousers needed considerable mending, although some could have been worn longer.

Choosing Materials

The results of this experiment showed that under normal conditions, the 16-ounce, or the heaviest fabric, would wear no longer than the 14-ounce material. Both were equally strong after 4500 hours of wear, the 16-ounce fabric having lost strength faster during the last wear period. Measurement of other fabric properties gave the same result, though one would not have anticipated this during the first stages of wear.

At the same time, the 12-ounce fabric apparently would not wear as well as the 14-ounce material if compared on the same basis. This difference in service which one might expect to get from fabrics of different weights could be expensive if the heavier fabric were to cost more per square yard than the lightweight material.