EVALUATION OF THE APPEARANCE OF MEN'S WORN AND NON-WORN DURABLE PRESS WORK TROUSERS OF ALL-COTTON AND COTTON-POLYESTER BLENDS

A DISSERTATION

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I N T R O D U C T I O N

The study reported herein was conducted for the purpose of making a comparative analysis of a number of durable press treatments with reference to their appearance in men's trousers. Evaluations were made of 200 pairs of worn and non-worn trousers through a series of controlled laundering periods. Five groups of trousers representative of three types of experimental finishes on 100 per cent cotton and two blend levels treated with finishes which are currently on the market were compared with respect to their durable press performance.

For untold centuries man has enjoyed the cool comfort of cotton as well as its long-lasting durability. Progressively, since the advent of wash-and-wear fabrics in the fifties, the consumer has been less inclined to buy fabrics which require ironing. Although the earlier attempts were less than satisfactory with respect to smooth appearance, the introduction of the Koratron process by Koret of California in 1964 appeared to be the answer to a truly smooth no-iron garment. Almost immediately, however, it was evident that the crosslinking process which imparted the desired smoothness also weakened the abrasion resistance level of cotton below acceptable standards for durability.

This problem was overcome by the intimate blending of cotton with polyester which has outstanding abrasion resistance. Since the necessity of blending, which caused a sharp drop in cotton consumption, it has been the aim of the cotton producers to perfect a finish for 100 per cent cotton which will enable the fiber to compete in smooth appearance and crease sharpness with blends, without the loss of its durability.

Hollies of the Harris Research Laboratories and Getchel of the National Cotton Council (23) have worked toward the development of a durable press cotton in which the finishing resins are deposited inside the wet, swollen cotton fiber. Later, the addition of a catalyst and a high-temperature-dry-cure treatment results in less loss of fabric strength than is caused by conventional pad-dry-cure methods for durable press treatments.

One of the experimental finishes used in this study was applied by means of a wet-fixation process to all-cotton fabric. Its performance was compared with the performance of other finishes by means of the following objectives.

SPECIFIC OBJECTIVES

The specific objectives of this study were:

1. To secure five types of durable press trousers representative of the following fiber-fabric-finish categories:

   a. 100 per cent cotton, 3/2 twill, with a wet-fixation treatment,

   b. 100 per cent cotton, 3/2 twill, with a modified pad-dry-cure treatment,

   c. 100 per cent cotton, 3/2 twill, with a standard pad-dry-cure treatment,

   d. 65/35 per cent intimate blend of cotton-polyester, 3/1 twill, with oven baked durable press treatment,

   e. 50/50 per cent intimate blend of cotton-polyester, 3/1 twill, with "Lock Prest" durable press treatment;

2. To subject the trousers to 30 periods of wear by white and blue collar workers followed by laundering and to laundering without previous wear;

3. To evaluate the trousers with respect to soil before and after laundering;

4. To rate the fabric smoothness, retention of pressed-in creases, and the smoothness of the seams after each laundering cycle;

5. To evaluate the appearance of the worn trousers on the men during every fifth wear period;

6. To secure the opinion of the wearer during every fifth wear period with reference to his idea of appearance; and

7. To analyze trouser fabric with respect to yarn count and fabric weight.

REVIEW OF LITERATURE

Durable press garments are accepted widely by the American consumer today. In discussing the changing standards of the consumer, Powderly (38) states that a few years ago a woman would not complain about ironing a shirt, since this was a way of life which accompanied a wedding ring. Today, the housewife is offered the alternative of not ironing, because of the introduction of durable press fabrics, and she is fond of the release from what she regards as labor.

The introduction of resin treatments of fabrics, which was attributed to Tootal, Broadhurst and Lee in England in the early 1920's, was the forerunner of the durable press treatment. The pioneering work of J. T. Marsh of that company, as related by Steele (50), was based on the hypothesis that the treatment of fabrics with synthetic resin-forming materials would cause them to receive a liveliness and resilience in the same manner that water is able to distend a canvas hose pipe from an empty, flat, lifeless ribbon to a lively and elastic structure.

Reid (43) accredits the patents of 1953 and 1954,

which covered the pleating of fabrics by means of drying a resin in a cellulose fabric and later introducing pleats followed by heat setting, as possibly being the germ of the idea of durable press. From these early concepts, many ideas have developed concerning the principles which underlie the durable press phenomenon. One is the hypothesis that the crosslinking of cellulose which is responsible for durable press properties may be attributed to hydrogen bonding. One of the most accepted hypotheses today, however, is that the linkages are formed by establishing covalent chemical bonds between the molecules of the individual fibers. These bonds may be viewed as molecular bridges from one cellulose chain to another.

Rowland (47) explains the fact that, although a cross section of cotton fiber reveals no pores or channels even at the high magnification of an electron micrograph, it is evident that the crosslinking agent finds many pores and channels through which it may reach the hydroxyl groups on the surface of the micro-structural units. A slower phase of the reaction, according to this investigator, involves hydroxyl groups beneath the surface because the alkali which is used during mercerization penetrates the structure of the elementary fibrils and causes the fibers to swell. He explains further that the crosslinking of cotton improves the dimensional stability and easy-care durable press performance through chemical reactions which

place physical restraints on the microstructural units in the fiber. Further, he postulates that the cotton fiber is composed of many microstructural units which form microfibrils composed of cellulose molecules joined together in a linear chain, which feature in the reaction. The hydroxyl groups in the cellulose molecule are buried in a catacomb-like labyrinth in the cotton fiber, and therefore only a fraction of these hydroxyl groups are accessible for reaction. A further description of the crosslinking reaction was given by the author as follows:

> Moreover, there are two different types of hydroxyl groups in the fibers of cotton cellulose: i. e., secondary hydroxyls at carbon atoms 2 and 3, and primary hydroxyls at carbon atom 6 of each D-glucopyranosyl unit. These three hydroxyl groups react at different rates and the linkages developed exhibit different stabilities.

Reid (42) states that the theory behind durable press is quite simple, and that both surface and deep-seated reactions occur during the treatment. He describes the surface reactions as topochemical and the deep-seated reactions as the linking of the hydroxyl groups to produce a "set." In general, the fabric is treated with a solution which contains a crosslinking agent along with an additive softener and other ingredients. He compared the setting process of cotton with the process by which a permanent wave is put into a lady's hair. Crosslinking prevents the long cellulose chains from slipping on each other and keeps

them firmly in the configuration which they held at the time of curing.

As a result of concentrated research efforts pertaining to the crosslinking of the cellulose fiber, the first Sta-prest men's pants introduced by Levi Strauss appeared in retail stores in February of 1964. American Fabrics (35) reported that they were not in the stores for long, because they sold out faster than they could be delivered. These pants utilized the Koratron process which gave highly acceptable crease and smoothness standards but were lacking drastically in durability.

The Koratron process is widely known as a post-cure process. As described by Reid (43), the fabric is impregnated with a reagent which reacts with the cellulose, but is dried at a low temperature so that a minimum of crosslinking occurs. Thus, the fabric is sensitized but not cured. After the garment is cut, sewn, and pressed, it is passed through an oven at a high temperature in the range of 300°F., where the fibers are set in whatever position they occupy at that moment. When the garment is laundered and dried, these fibers return to their original configuration and a smooth-drying fabric results. The post-cure process is generally used on garments of heavier weight such as men's pants composed of 65/35 and 50/50 polyester-cotton blends.

In reviewing the development of the post cure process, Hochstaedter (22) stated that the basic process was developed by Koratron, a wholly owned subsidiary of Koret of California who licenses the process both to fabric suppliers and garment manufacturers. Standards of quality control are checked in the Koret Laboratories.

Another route to durable press is the re-cure process. A fabric is dyed, finished, and completely cured in the finishing plant. The flat, cured fabric is shipped to the manufacturer and garments are made therefrom. Some of the cross links formed in the pre-curing stage can be broken in the presence of steam from pressing and reformed or set in the press or oven. The Coneprest treatment is achieved by this method. The Coneprest III Technical Bulletin (12) recommends that finished garments be pressed before oven treatment, with 5000 to 8000 pounds of head pressure and with temperatures ranging from 300-325°F. for 10 to 15 seconds. Coneprest III is available in reinforced cotton blends and synthetics. With this treatment it is possible to create durable creases or pleats in a pre-selected area of the garment or article with hot-head presses normally available in the apparel manufacturing plant.

Stultz (51) (52) (53) reported the garment treatment method as a means of imparting durability to cellulose. He described this process as being one in which the untreated

garment is dipped into a resin-latex bath consisting of a cyclic ethylene-urea formaldehyde resin and a butadiene-acrylonitrile latex. Afterward, the garment is removed and extracted to about 50 per cent pick-up by weight of the resin-latex bath, steam pressed, and dried for five minutes at 350°F. in order to cure the garment and set the creases. The durable press appearance of garments thus treated, according to Stultz, rates almost as satisfactory as other methods and the abrasion resistance and strengths are improved significantly.

A mechanical process reported by American Fabrics (36) for increasing the strength of cotton fabrics has been patented by a Swiss firm and is being licensed throughout the world under the Sanforized trademark. It is known as the micro-stretching process which stretches the fabric in the filling direction and increases strength by 30 to 40 per cent. Tests have shown that strength losses of cotton can be cut in half by the M-S treatment. This makes possible the use of lighter filling yarns without affecting quality or performance.

Troope (54) describes this procedure as one in which the fabric is mechanically stretched beyond its elastic recovery. This stretching results in an alignment and reorientation of yarn and fiber components, which produce

a reduction of tensile and tear strength losses due to the application of wash-wear or durable press type finishes.

The micro-stretching process has been teamed with a resin in "core-cross-linking" on cotton fabrics reported by Dr. Lauchenauer (7) of Switzerland at the 17th Chemical Finishing Conference. This development combined the previously known micro-stretching process with a conventional resin by a method that tends to deactivate the fiber surface while permitting the usual crosslinking within the fiber. Results of plant runs showed that strength losses were reduced 30 to 60 per cent, and Stoll flex abrasion resistance was increased 300 to 1000 per cent when this method was used. In actual laundering tests, garments treated by the process showed no holes at critical points after 30 laundering periods.

A most promising approach to the chemical modification of cotton to impart desirable chemical and physical properties has been presented in a preliminary and exploratory report by Rebenfeld (39) of the Textile Research Institute of Princeton, New Jersey. This anionic graft polymerization of acrylonitrile on cotton yarns by means of sodium cellulosates was accomplished with no apparent degradation of the cellulose. With only low levels of graft modification, the mechanical properties of the grafted yarns were essentially the same as the untreated controls,

which indicated that no degradation had taken place. There was some evidence of improved thermoplastic character although there were no apparent changes attributable to the grafting in the thermol properties, as revealed by different thermol analyses.

An interesting study concerning the effects of radiation-initiated graft copolymerization has been reported by Harris et al. (19) from the Southern Regional Research Laboratories in New Orleans. Commercial cotton print and twill fabrics were scoured and dried to less than two per cent moisture content and sealed in an atmosphere of nitrogen. These fabrics were irradiated to a dosage of one megarad with cobalt-60-gamma-radiation at Natick, Massachusetts. After a time lapse of four to seven days, the irradiated cotton fabrics, which contained long-lived free radical sites, were graft copolymerized in the absence of oxygen at the New Orleans laboratories. Fabrics were immersed in solutions of vinyl monomers from which inhibitors of polymerization were removed by passing solutions of the monomers through columns of activated alumina. The DMDHEU which was used for crosslinking was Permafresh 183 to which catalyst X-4 (reportedly zinc nitrate), and a wetting agent (Titron X-100) and water were added.

Simulated pants legs with cuffs were used by Arthur, Harris, and Mares (6) for testing cotton fabrics which had

been copolymerized with the radiation-initiated graft procedure. Results of the tests indicated improved wash-wear ratings, abrasion resistance, tear strength, and wrinkle recovery angles over those fabrics which had not been copolymerized.

Additional work is continuing in an effort to select combinations of vinyl monomers and crosslinking reagents which will contribute toward maximum improvements in the durable press properties of all-cotton products. Polyurethane applications before, along with, or after crosslinking have been found effective in improving wrinkle recovery and abrasion resistance according to a study done by Morton, Hall, and Reid (32). In this investigation, polyurethane treatment gave a degree of dimensional stabilization, even under extreme laundry conditions. The problem of yellowing was more pronounced when polyurethane was included in the crosslinking pad bath than when it was present in a pre-treatment application. DMMC treated fabrics exhibited three times more resistance to laundry abrasion than did fabrics treated with DMPU.

All-cotton durable press fabrics were found by Blanchard *et al.* (9) to be improved by a treatment with urethane. Regular 3/2 twill woven from 40/2 pima cotton yarns and made into simulated trouser cuffs was treated with a durable press finish plus urethane and subjected to

repeated launderings. Abrasion resistance and wrinkle recovery performance were improved substantially by impregnating fabric with urethane latex prior to the application of crosslinking resins. A high degree of wrinkle recovery and crease sharpness also was reported.

By combining polyacrylate with the crosslinking agent, Harper, Blanchard, and Reid (18) also found in the repeated washing and tumble drying of simulated trouser cuffs improvements from 1.5 to 3.0 times in cuff abrasion performance over a control treatment. The preferred pad bath formulation consisted of a four per cent or more of polyacrylate solids, 65-80 per cent of the normal amount of crosslinking agent required for durable press, and a softener. By making proper allowances for the contribution of polyacrylate to wrinkle recovery, the amount of crosslinking agent concentration was reduced, thus improving the abrasion resistance. This study also showed that polyacrylates improved the wrinkle recovery (both wet and conditioned) and the breaking strength of crosslinked cotton fabrics as well as the crease sharpness of cuffs.

The blending of cotton fibers impregnated with delayed-cure type thermosetting resins with untreated cotton has been undertaken by Knoepfler et al. (25), a research team at the Southern Regional Research Laboratories, as a means of providing improved durable press properties to

all-cotton fabrics. These fibers, woven into 3/2 twills and sateens, were made into cuffs which were subjected to cycles of washing and tumble drying. In all cases the cuffs made from fabrics composed of blended fibers were superior in abrasion resistance to the controls made from conventionally padded and cured fabrics. Blends of treated and untreated fibers also exhibited good crease retention.

A process for finishing cotton to impart high levels of wet and dry wrinkle resistance by means of a simple mild cure treatment without prior drying of the fabric has been reported by Reinhart, Cashen, and Reid (44). This process may be considered a modification of the European moist crosslinking techniques to give a faster treatment, as well as one more suitable for American finishing practices. Dimethylol carbamate agents are particularly suitable for this mild cure, with hydrogen chloride being an effective catalyst. The properties of cotton finished by the mild cure process are essentially equivalent to those of fabric treated by the conventional pad-dry-cure treatment with the principal differences being a higher level of wet wrinkle resistance, smoother drying performance after drip or line-drying, and poorer resistance to chlorine damage. The research team explained the mild cure as follows:

> The crosslinking reaction in mild cure finishing is believed to proceed by a carbonium ion mechanism through protonation of methylol moieties of the

> crosslinking agent by the strongly acidic catalysts used. Apparently, this mechanism is operative under the mild curing conditions and without the necessity of essentially complete dehydration of the fabric in treatment. Chemical and physical evidence support the mechanism proposed. Hydrolysis of fabric finished with dimethylol carbamate has confirmed that there are essentially no methylene crosslinks present.

Further research by Reinhardt, Cashen, and Reid (45) on the mild cure finishing process for producing wrinkle-resistant cotton has been carried out for the purpose of perfecting a more rapid process. They have produced finished cotton print cloth with properties characteristic of the moist type process by a two minute cure at 100°C. without prior drying. Cotton finished by this process was found to have good wrinkle resistance and better durable press properties after line drying than most pad-dry-cure finished fabrics and exhibited greater soil release than untreated fabrics, according to this research team. Curing times as low as one minute have proven to be successful.

Preferential crosslinking has produced durable pressed cotton fabrics with good abrasion resistance according to Reeves et al. (40). In this process the crosslinks which provide crease retention and wrinkle recovery are placed in specific regions of the fabric rather than uniformly throughout the fabric structure. When the crosslinks are put into the back of fabrics leaving the face without crosslinks, the fabrics exhibit abrasion resistance equivalent to untreated cotton fabrics.

In the absence of crosslinks or other special finishes on the face of preferentially crosslinked fabrics, there is excessive build up of loose fiber ends on the face of the fabric which causes a frosted or faded appearance. This has been prevented by the application of from one to three per cent face coat of polymer before preferentially crosslinking the cotton in the back of the fabric. Fabrics treated by this technique and made into durable pressed cuffs for testing exhibited abrasion resistance, as measured by tumble drying, nearly equivalent to that obtained with durable pressed cuffs made of 15 per cent 420 nylon and 85 per cent cotton.

Techniques for preferentially crosslinking studied by Cooper et al. (14) provided from five to 13 times the abrasion resistance as was provided by the conventional crosslinking procedure. Wear and performance evaluations of pants cuffs after 20 cycles of washing and tumble drying showed that the preferentially crosslinked fabric had an equal wash and wear appearance and a small, but definite improvement in wear resistance.

Later reports by the above group (13) on the wear life of simulated trouser cuffs which compared conventionally resin treated and preferentially resin treated cotton fabrics showed that the preferentially crosslinked fabrics had improved physical properties and resistance to abrasion

damage during laundering, but lost considerable recovery performance. The results proved that garments which require no ironing after washing and tumble drying could be produced by this method, but that the wrinkle recovery during wear may not be satisfactory.

In discussing new techniques for cotton finishing, Reeves (41) related that improved abrasion resistance in cotton durable press goods can be accomplished by the use of selected polymers of urethane, silicone, polyether and acrylate, which coat the surface of the fibers and then react to produce polymers of great molecular weight. According to Reeves these polymers are helpful in improving abrasion resistance by making the fabric more supple, and by making possible the reduction of crosslinking agents up to 50 per cent, without loss of wrinkle recovery or smooth drying performance properties. The Poly-Set process is an example of this method.

In 1969, Hamalainen *et al.* (16) from the Southern Regional Laboratory developed a one-step procedure which used the first step of the Poly-Set process. They found that the type of N-methylol agent which was used determined the effectiveness of the durable press performance and that a resin combination of equal parts by weight of a modified methylolmelamine (MMM) and di,ethylolpropyleneurea (DMPU) was particularly effective when zinc acetate was used as

the catalyst and polyurethane and olefin were used as the polymeric additives. Smooth drying performance ratings were in the acceptable range for sheets and shirts with this process.

Jutras, Cicione, and Kennedy (24) studied the vapor phase treatment as a means of providing durable press properties for cotton fabrics. They found that this process resulted in higher tensile strength, higher wet crease recovery and higher flex abrasion resistance than were provided by the pad-dry-cure treatment. Crosslinking the fibers in a less collapsed state in the vapor phase treatment than under the curing conditions of the padding techniques was responsible for these differences according to the authors.

Goldstein (3) pointed out a disadvantage of the vapor phase treatment in that the several thicknesses of a garment require a long processing time for the vapor diffusion into the cloth and that an equally long time is required for the unreacted vapor to leave the cloth in order to eliminate odors.

One of the more promising processes for producing durable press fabrics is the wet-fixation process which was first introduced by Getchell and Hollies (2) (23). The process involves the fixation of a polymerformer and a

crosslinker to cotton fabric under aqueous, acidic conditions. A solution of reagents is padded on at a pH of 2.0 and heated in a sealed condition, sometimes in a Mylar container, for 15 minutes at 180°F. to achieve fixation of the resins in a somewhat swollen fiber. The fabric is neutralized in sodium carbonate solution, washed, and dried. The heating step applied to the fabric in the wet state results in deposition of the resin in the fiber in such a manner that it is not removed by washing, and the fibers remain slightly swollen, thus providing fiber sites which are more accessible to the polymer.

Bille and Schonroch (8) reported that the wet crosslinking reaction results in an increase in the wet crease recovery angle with only a slight loss in strength. They designated dimethylol glyoxal nonureine (Fixapret) as the usual crosslinking substance employed for this procedure but stated that urethanes and carbamates also can react in like manner.

Work done by Vail and associates (7) showed that excellent durable press results can be obtained from a wet-fixation process which involves the use of a low resin add-on operating at pH 3.5 to 4.5 instead of the usual pH 2.0. Advantages of high pH operation of the wet-fixing process found by the authors include: the elimination of an afterwash following sensitization; more effective

utilization of resins; no surface polymer formation (a problem with pH 2.0 process); and less hazardous processing conditions.

Harris Research Laboratories (2) demonstrated the improvement of the wear life performance of durable press cotton garments by a wet-fixation process. Two different types of resins were used to give trouser cuffs longer life and other desirable qualities. A standard cotton twill fabric made up into trouser cuffs was treated with a combination of melamine triazone resins. After curing these cuffs were compared for performance and wear life with similar trouser cuffs made from fabric treated by the conventional delayed cure process. Initially, the two fabrics had comparable crease retention and wash-and-wear performance. After 20 cycles of accelerated home laundering and tumble drying, the wet-cure cuffs showed significantly better shape retention than did the conventional controls as well as superior wear life as evidenced by hole formation and edge wear along creases and cuff points.

Vail et al. (57) concluded that the wet-fixation process is promising for the production of durable-press cotton with commercially acceptable resistance to abrasion. Room temperature fixation, which can be carried out with lower reagent requirements, and moist fixation which requires high amounts of reagent but normal drying

procedures, have been found to be the most promising. A major influence on wrinkle recovery and abrasion appears to be the degree of swelling and the manner of partial polymerization. The evaluation of several wet-fixation processes carried out through laundering tests of simulated cuffs by Vail et al. (58) proved the merits of polyurethane in providing improved durable press properties.

In 1968, Modern Textiles Magazine (33) cited plant trials as the next step in checking out the performance of wet-fix processes for all-cotton. At this time four wet-fixation systems, all with higher abrasion resistance, tear and breaking strength and improved smooth appearance in the laboratory, were ready for mill testing. All systems required simpler, less costly plant procedures with less odor both in processing and in the finished product.

American Dyestuff Reporter (56) announced the awarding of a contract by USDA to the United Merchants Research Center, Langley, South Carolina, for the purpose of developing a chemical process for imparting durable press characteristics to cotton fabrics on a commercial scale. This process, which uses steam to lock durable press chemicals in cotton, was developed at the Southern Utilization Research Laboratory, New Orleans, Louisiana, under the direction of Dr. Sidney L. Vail who is the technical representative for the project.

Other efforts designed to improve the properties of durable press fabrics involve the use of catalysts. Buchholz (10) stated that the effect of a catalyst on the pH of the finishing bath has been found to influence the complexing and condensation reactions which are reflected in pad bath stability and finished fabric performance. Degradation by the crosslinking agent of a cellulose, which lowers the overall performance of the fabric can be the result of an excessive use of catalysts. Since the curing characteristics of crosslinking agents are determined largely by the catalyst, careful balancing of crosslinking agents and catalysts properties must be utilized in the durable press finishing procedure. Catalysts can contribute to yellowing of cellulose and can affect the chlorine retention properties, influence odor formation, and cause shade change or dyeing fastness problems in finished fabrics.

Pierce, Boudreaux, and Reid (37) found that mixtures of certain metal salts were more active catalysts than either compound used separately. The enhanced activity of mixed catalysts enables the same degree of crosslinking to be obtained by a lower than normal concentration of catalyst in the pad bath, shorter curing time, lower curing temperature, or any combination of these three parameters.

Although durable press imparts shape retention qualities to a garment throughout its wear life, the cross-linking that takes place as the garment is treated chemically

reduces the tear strength and abrasion of all cellulosic fabric as much as 50 per cent or more. The blending of synthetic fibers with cellulose has been practiced widely as a means of restoring strength and abrasion resistance to durable press fabrics. In discussing synthetic fibers in durable press, Lee (29) designated nylon and polyester as the most important fibers for blending. The thermoplastic characteristics of these fibers contribute materially to crease retention. Blends of cotton and nylon containing 20 per cent nylon have approximately twice the resistance to abrasion as 100 per cent cotton and studies have shown that a minimum of 15 per cent Type 420 nylon staple both in the warp and filling provides sufficient durability for 8.5 ounce and heavier fabrics.

Stultz (53) attributes strength retention, edge abrasion resistance, and flex abrasion resistance to polyester. He describes it as having color styling potential, shape retention, and a more aesthetic hand and appearance than all-cotton garments.

Studies have shown that the serious wear deficiencies of permanently pressed cotton garments can be overcome by replacing 50 to 60 per cent of the cotton with polyester. The best performance for 3 1/2 ounce or lighter fabric has been found to be 65/35 polyester-cotton; however, for heavier fabrics of 4 1/2 ounces or more 50/50 blends have

been found to perform well, according to American Fabrics Magazine (36). Dacron 59 is among the polyester fibers used in the 50/50 blends. It is described by Du Pont (15) as semi-dull, and more stable, and more disperse-dyeable, for heavier weight apparel and industrial fabrics.

The proposal that, if polyester were made stronger and everything else remained equal, the quantity of polyester required for blends might be reduced roughly in proportion to its increase in strength has been verified according to Heitmiller (21). Through the cooperation of a cotton mill with Beaunit Mills it was demonstrated that 35 per cent of a new product known as Vycron "Tough Stuff" competed successfully with other polyesters at the 65 per cent blend level. In discussing the merits of Vycron "Tough Stuff," Reid (43) describes the fiber as having higher tenacity and lower elongation than regular polyesters. Beaunit (60) has provided the following information:

> Vycron Tough Stuff elongates at about the same rate as cotton. So they back each other up. And make for an altogether durable fabric with greater abrasion resistance. And longer wear.

Cantor (11) explained the reason for the success of Vycron in blends with cellulose with the following statements:

> The maximum wear life of a durable press blend should be achieved with fibers whose moduli are compatible to the rupture point of the weakest fiber. If this weakest fiber is cotton or rayon, then the

modulus of the stronger fiber should match that of the cellulosic fiber treated for durable press.

As a means of producing durable press properties without the weaknesses which are imposed upon the fabrics by the resins involved, three systems for producing a non-resin permanent press have been announced recently by Modern Textiles Magazine (31). According to this announcement a new type of polyester which relies on the heat-setting properties of synthetics removes the need for resin. Celanese announced Fortrel T405 in April, 1970. A month later, American Viscose introduced a spun yarn-continuous filament construction combining regular polyester and high wet modulus rayon. Then Dow Badische made known its combination of polyester with acrylic in spun yarns, both singles and two-ply, with only a regular hot-head press required for curing.

Another factor which has been found to contribute to the durability of a durable press fabric is that of construction. Looney (30) has reported increases in the abrasion resistance of durable-press polyester-cotton blend fabrics through proper selection of fabric construction. High fiber mobility through soft constructions such as twill weaves has been found to minimize abrasion damage; however, gains in this direction must be balanced against loss of cohesion which can increase pilling. This deficiency has

been overcome by an increase in the number of threads per inch. An increase in the total number of fibers in a yarn system subject to abrasive damage also has been found to increase durability. These findings roughly parallel studies of 100 per cent cotton reported by Kyame (26) (27) wherein thirty-six test trouser cuffs, four from each of nine experimental fabric structures, were subjected to a series of launderings ranging from 80 to 115. Kyame's findings were as follows:

> Within each group of fabrics made from yarn of the same number, wear occurs first in the plain woven fabrics; next in order are the sateens, the 63° steep twill, and the 45° regular twills. Within the limited range studied, no appreciable effect of yarn twist is evident. The fabrics made from single yarns outperform comparable fabrics made from ply yarns. Similarly, fabrics made from the coarser yarns outperform those made from the finer yarns.

Kyame confirmed the fact that fabrics made from 20/1 yarns performed far better with reference to crease recovery than those made from the 30/1 and those made from both plied yarns, and that an increase in either warp or filling thread count adversely affected fabric performance in the washing machine.

In a later report Kyame (28) stated that the findings thus far allow only the following generalizations concerning the effect of weave and yarns upon the durable press properties: twill weaves perform better than plains;

single yarns outperform equivalent plied yarns in fabrics of the same kind and weight; and coarse yarns outperform fine yarns in equivalent fabric construction.

Abbott (1) found that wrinkle recovery in cotton fabrics can be improved by opening up a tightly woven construction by the use of a twill or sateen weave in place of a plain weave, but that the behavior of a more open fabric is not affected by changing the fabric construction.

Ruppenicker, Kyame, and Little (48) evaluated the effects of weave, yarn size, and yarn twist on all-cotton suitings which were treated with Permafresh 183 for durable press. These fabrics were made into pants legs, cured for eight minutes in a circulating oven at 320°F. and then washed and tumble dried 30 minutes. Yarn mobility within the fabric structure appeared to account for differences in the laundering wear of the fabrics tested. Plain weave fabrics exhibited poor laundry wear compared to more flexible baskets, ribs, twills, and sateens. Fabrics woven from coarse filling yarns performed better than those of comparable weight woven from finer yarns. Yarn twist had no significant effect on fabric performance.

In order to determine the actual in-use performance of durable press trouser fabrics, a number of wear studies have been conducted. Hearne and Broome (20) were among the first to conduct such a study. They compared the

performance of durable press finishes with regular wash-and-wear finishes. Eighteen pairs of girls' slacks were constructed from three durable press fabrics of intimate blends of polyester and cotton and 18 pairs were made from fabrics which were comparable to the blends in all aspects except for the fact that the finish was a regular wash-and-wear. These slacks were worn by ninth-grade girls for 25 eight-hour wear periods. They were washed in a home washer at 140-145°F., tumble dried, and smoothed by hand. Wash-and-wear appearance, smoothness of seams, and sharpness of creases were evaluated by a panel of three trained textile technologists. Strength tests also were performed.

The durable press fabrics were superior in performance to the wash-and-wear fabrics relative to wash-and-wear appearance of the fabric, seam smoothness, and sharpness of creases. The wash-and-wear fabrics seemed to show more excellent strength qualities, especially in the filling direction with reference to wet and dry tensile strength, wet and dry tearing strength, and resistance to flat abrasion. They also surpassed the durable press both in the warp and filling directions in flexing and abrasion tests.

Zey (61) investigated the performance of three durable press fabrics of polyester-cotton blends with respect to their appearance and physical characteristics during 15 periods of wear and laundering. Skirts were

constructed from 50/50 polyester-cotton and 65/35 polyester cotton fabrics and were worn by nine teen-age girls for two wear periods of seven hours before each of 15 laundering cycles. A panel of five judges evaluated the sharpness of creases, smoothness of fabric, lengthwise seams and crosswise seams, imprints of pleats from top side of the garment, and the zipper area. There was a difference significant at the one per cent level in the appearance of fabric, crease retention, and smoothness of lengthwise seams for all three fabrics, both in the new and test garments over the 15 periods of wear and laundering. There was a significant difference at the one per cent level within the three types of fabrics in relation to crease retention and smoothness of fabric with the 65/35 polyester-cotton rating lower in both categories.

Hanna (17) conducted a study of boys' durable press trousers representing the re-cure and the deferred cure processes. Five fiber content categories in two types of weaves were subjected to two procedures of laundering, one with tumble drying and one with line drying, and to dry cleaning. Boys between the ages of 12 and 17 years of age wore the trousers three days each week for a total of nine weeks. The trousers were evaluated each week by a panel of three who rated them in accordance with the AATCC visual standards with reference to appearance of fabric, seams,

zippers, and creases. Trousers of all-cotton and cotton-nylon blends that were tumble dried rated higher than those which had been line dried, with the all-cotton surpassing the cotton-nylon. The laundered trousers of 50/50 polyester-cotton, 65/35 polyester-cotton, and 65/27/8 acrylic-rayon-acetate exhibited smoother materials at the end of the study than those that were dry cleaned, with the exception of the 65/35 polyester-cotton which rated the same. The garments that were laundered and tumble dried received the highest scores in all instances with reference to wrinkle recovery, smoothness, and overall outside appearance.

Roch (46) compared the durable press performance of 121 pairs of boys' durable press trousers finished by means of the Koratron process and representative of blends of 65/35 and 50/50 polyester-cotton and 85/15 cotton-nylon. Sixty-four pairs of trousers were worn by third grade boys 10 to 11 years of age. The wear period of eight hours was followed by laundering and tumble drying for 35 cycles of wear and laundering. Evaluations were made of the worn trousers after each laundering period in relation to wash-and-wear appearance, crease retention, seam smoothness, evidence of wear, staining and color change. The non-worn trousers were withdrawn at designated intervals in the laundering periods for physical testing. Throughout the 35 periods of wear and laundering the polyester-cotton

trousers maintained the highest level of performance in relation to smoothness of the fabric and seams and sharpness of the creases. Sharpness of creases was lessened irrespective of the fiber content by wear and laundering.

Turner (55) tested 66 pairs of men's durable press trousers of all-cotton with three finishes and blends of cotton-polyester through 15 periods of wear and laundering in a home-type automatic washer and tumble dryer. Evaluation of fabric smoothness, crease performance, and general wear followed each laundering period. Fabric of 100 per cent cotton with a Fixapret CP-40 finish fell short of expectation with reference to durable press appearance and crease retention, but gave results which were slightly superior to those provided by the Fixapret PCL treatment. Fabric of 100 per cent cotton with a Koratron finish gave excellent appearance, crease retention, and sharpness of creases, but fell short in tests of durability. Fabric of 65/35 and 50/50 cotton-polyester performed exceptionally well throughout the study with respect to durability and appearance tests. Overall, the performance of the experimental fabrics in this research study ranked as follows:

Rank	Fiber	Finish
1	65/35 Cotton-polyester	Coneprest III
2	50/50 Cotton-polyester	Koratron
3	All Cotton	Fixapret PCL
4	All Cotton	Fixapret CP-4
5	All Cotton	Koratron

Since early in the development of durable press fabrics, the retention of natural oily and inorganic soils and food stains has been of concern to many in the field of textile research. Norris (34) offered as an explanation of such soiling the fact that polyesters are basically hydrocarbons which cause them to be very hydrophobic and oleophilic. The hydrophobic nature of polyester makes it prone to a type of soiling known as wet soil redeposition. When polyester-containing fabrics are washed with wash loads containing soil, particularly oily-type soils, the soils are, over a period of time, redeposited over the surface of the polyester fibers. The surface of the polyester fiber is difficult to "wet" making complete removal of the soil more difficult. Wham (59) explained further that the problem in removing oily stains or soil exists because these hydrophobic fibers, such as polyester and also cellulosic fibers such as cotton, were made hydrophobic by crosslinking resins which strongly attach themselves to hydrophobic soils.

Roch (46) evaluated the amount of stain which remained in the experimental trousers in her study. She found that both the all-cotton and the polyester trousers exhibited an increased amount of staining throughout the 35 periods of wear and laundering. The failure of the fabrics to release stains was evidenced, with significant differences

in the retention of stains by the various blends used in her study.

Turner (55) reported that neither the fiber content of the fabrics nor the durable press finish had any direct effect upon the extent of soiling and staining which the trousers which she tested had suffered. The degree of soiling seemed more dependent upon the activities for which the trousers were worn. She found the durable press treatment to be a greater influential factor in this respect than the fiber content. Oily stains were more difficult to remove from all fabric categories as the wear-laundering periods increased.

PLAN OF PROCEDURE

DESCRIPTION OF TROUSERS

This study involved an evaluation of 200 pairs of men's durable press khaki trousers constructed from five different fabric types representative of 100 per cent cotton and intimate blends of 65/35 and 50/50 cotton-polyester, respectively. The experimental trousers were classified with reference to their fiber content and fabric finish as Types A (100); B (200); C (300); D; and E, with 40 pairs of trousers under each respective type.

Trouser Types A, B, and C were alike with respect to fiber content (100 per cent cotton) and weave; but they were different in relation to their durable press finishes. The 65/35 blend contained Vycron "Tough Stuff" polyester, whereas Dacron 59 polyester was used in the 50/50 blend. See Summary A for other information concerning fabric characteristics. The style of the experimental trousers was of the executive cut, with straight legs, cuffs, and belt loops.

SUMMARY A

FABRIC CHARACTERISTICS

Fabric Category	Fiber Content	Durable-press Treatment	Yarn Count		Weave	Weight in Oz./Sq.Yd.
			W	F		
A (100)	100% Cotton	Wet fixation (melamine)	98.0	55.8	3/2 twill	7.6
B (200)	100% Cotton	Modified pad-dry-cure	96.0	56.6	3/2 twill	7.6
C (300)	100% Cotton	Koratron	95.5	55.6	3/2 twill	7.4
D	65/35 Cotton-Polyester	Coneprest III	116.4	50.6	3/1 twill	8.2
E	50/50 Cotton-Polyester	Lock-Prest	113.2	49.0	3/1 twill	7.3

The 200 pairs of trousers were divided into three general groups in preparation for the study. A total of 150 pairs (15 of each of the five types) was assigned to two respective groups of men for wear before laundering, whereas the remaining 50 pairs were laundered without previous wear.

SELECTION OF WEARERS AND ARRANGEMENTS FOR WEAR

Group I wearers consisted of 15 volunteers from Texas Woman's University Research Institute and from other colleges on the campus, who were engaged in various activities, such as laboratory work, which resulted in light soiling and abrasion of their apparel. Group II was composed of 15 volunteers from the maintenance personnel of Texas Woman's University whose activities subjected their clothing to hard wear and heavy soiling. These men were engaged in such activities as garbage removal, yard work, carpentry, and also in electrical and mechanical services. Neither age nor size was considered in the make up of the two groups.

A set of five pairs of trousers, one from each fabric category shown in Summary A, was issued to each wear-panel member and fitted for necessary alterations. Although the trousers were purchased according to the measurements of the wearers, 75 pairs required some alterations,

which ranged from an adjustment of waist size to a shortening of the leg length.

The 15 panel members of each respective wear group were arranged in alphabetical order and issued a number which ranged from one to 15. The group number, the fabric code letter, and the number of the wearer were marked permanently in the waistband of each pair of the experimental trousers. Non-worn trousers were marked only with a fabric code letter and a trousers number.

The wearers were instructed to wear each pair of trousers for a minimum of eight hours on the job and to return them to the research laboratory to be laundered soon thereafter. The trousers were subjected to a total of 30 periods of wear and laundering or withdrawn when considered unfit for continued wear.

Ten pairs of trousers from each fabric category were subjected to thirty laundering periods without being worn for the purpose of making a comparison of the amount of fabric damage which resulted from wear and laundering to that caused by laundering only.

EVALUATION OF SOIL

After each eight-hour wear period the trousers were returned to the research laboratory for laundering and

inspection. As the worn trousers were received they were subjected to a visual inspection to determine the amount of soiling which they had incurred during wear. This was done under a fluorescent light placed 18 inches above the trousers. During each evaluation period the evaluator noted the amount of soiling and rated each pair of trousers according to the following scale adapted from scales used by Roch (46) and Turner (55):

Rating	Description of Soiling and Staining
5	Clean over all; no visible spots or stains.
4	Light soil; small oil stains; pencil and ink marks or other discoloration.
3	Medium soil; medium-sized or many oil, food or earth stains; shoe polish; small permanent stains.
2	Dirty overall; localized ground-in soil; large oil stains; splattered paint; persistent discolorations.
1	Heavy soil; dirty oil stains; large or many paint stains; other permanent, unsightly discolorations.

Clear oily stains which were detectable only under the light were marked with a circle of basting stitches. These stitches remained in the trousers throughout the laundering and subsequent evaluations and were removed before the trousers were issued again to the wearer. A soil evaluation was made after laundering by the same procedure as that which was used before laundering.

LAUNDERING PROCEDURE

In preparation for laundering, the trouser pockets were emptied and the zippers were closed. Spots of soil were treated with a paste of one part detergent and one part water and thereafter flushed under running water. Oily stains and grease were treated first with Picrin, a drycleaning spotting solvent, and then with the detergent paste. This solvent and paste were flushed out as the spots were rubbed by hand under running water. In the case of stubborn spots, a second treatment was necessary. The trousers which were heavily soiled with excessive amounts of black grease were spotted and hand rubbed from cuff to waistband. After the soiled spots were pretreated the trousers were folded into a pan of warm water until a washer load had been prepared for laundering.

The trousers were laundered in six-pound loads in an Imperial Mark XII Whirlpool washer equipped with a Kenmore 600 agitator. The regular cotton cycle with a high water level, a 140°F. washing temperature, a warm rinse, and 135 grams of a standard detergent without brightener or enzyme were used. The water was extracted with a high spin cycle.

The trousers were tumble dried in a Whirlpool dryer in six-pound loads for 20 minutes at a high temperature with

no cool down period. At the end of the drying period, they were removed immediately from the dryer, folded on the creases, smoothed by hand, and stretched along plackets and seamlines to insure maximum smoothness. A mark which indicated the number of launderings was made inside the waistband of the trousers near the identifying code after each laundering period. The trousers were hung by the cuffs with two clothespins to a wire hanger and permitted to hang for a minimum of 30 minutes before they were processed further.

APPEARANCE EVALUATION

After each laundering, both the worn and the non-worn trousers were evaluated with reference to their fabric and seam smoothness and their pressed-in crease retention by a three-member panel of textile technologists. Independent ratings were made by each panelist in accordance with the standard procedure for each type of evaluation.

Test Method AATCC 124-1967 (4-a) was the means employed for determining the smoothness of the garment after laundering. While the trousers were hanging over a rod attached to the viewing board of the overhead lighting device with the crease of the right leg from the crotch to the cuff in full view of the observer, and with the Three Dimensional Durable Press Replicas placed to the right of

the garment, a rating from 1.0 to 5.0 was given independently by the three panel members to each pair of trousers. This varied from the standard procedure in that standards were not hung on both sides of the garment during evaluation because of the amount of space required by the left leg of the garment.

The amount of puckering along the seam lines was assessed by means of Test Method AATCC 88B-1964 (4b). In preparation for these evaluations each pair of trousers was hung on the viewing board of the overhead lighting device with the outside seam of the right leg exposed from the crotch to the cuff. In this position the seams were compared with the standards provided by the American Association of Textile Chemists and Colorists for that purpose. The standards were hung to the right of the garment and the portion of the trouser seam opposite the standards was evaluated. A rating of from 1.0 to 5.0 was assigned independently by each of the panel members to each pair of trousers.

Test Method AATCC 88C-1964 (4c) was used for scoring the sharpness of the trouser creases. For these evaluations the trousers were hung over the rod with the crease of the right leg from the crotch to the cuff in full view of the observer. Two wire-clamp clothespins were fastened to the right cuff on each side of the crease as a means of defining

the crease and insuring that it was hanging straight. The AATCC Crease standards were placed to the right of the garment. The width of the shadow cast by the crease from the crotch area of the trousers to just below the knee was compared to the photographic standard and a rating from 1.0 to 5.0 was assigned independently by the three panel members to each garment.

EVALUATION OF APPEARANCE ON THE WEARER

During every fifth wear period an evaluation of the appearance of each pair of trousers on the wearer was made independently by a panel of three members. For these evaluations the wearer stood under a fluorescent light, six feet from the evaluation panel. The amount of wrinkling, the sharpness of creases, the smoothness of seams, and the general appearance of the trouser fabrics were evaluated as the wearer turned until the full garment had been exposed to the view of the panel. Photographic standards as shown in Figures 1-5 were used as the criteria for rating smoothness; and the rating scales given in Figure 6 were used in evaluating the seams, creases, and general appearance of the trousers. The panel members made their evaluations independently, and recorded their ratings on the score card shown in Figure 6, which was devised by the author and her director.

Immediately after the panel completed its evaluation of the trousers during the fifth wear cycle, the wearer was questioned subjectively concerning the appearance of the trousers. The nature of the answers which resulted from such questioning was not such as could be ranked in any orderly manner; therefore, beginning with the tenth wear cycle the wearer was asked to record his opinion of the trousers with reference to fabric smoothness, seam smoothness, crease sharpness, and comfort on a score card identical to the one shown in Figure 7.

FIGURE 1

STANDARD FIVE RATING FOR SMOOTHNESS

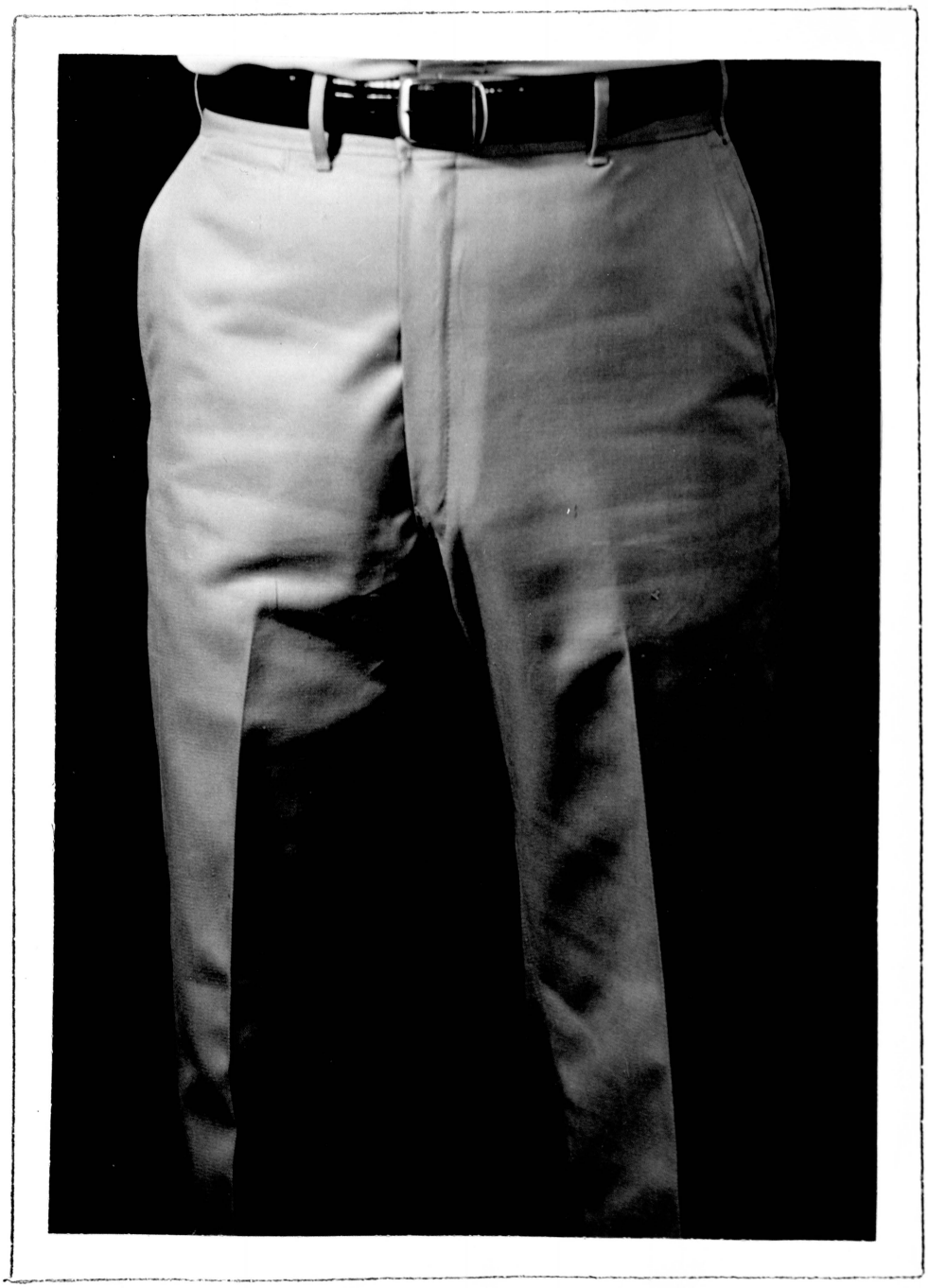

FIGURE 2

STANDARD FOUR RATING FOR SMOOTHNESS

FIGURE 3

STANDARD THREE RATING FOR SMOOTHNESS

FIGURE 4

STANDARD TWO RATING FOR SMOOTHNESS

FIGURE 5

STANDARD ONE RATING FOR SMOOTHNESS

_____Panelist _____No. of Launderings

_____Trousers Category

I. SMOOTHNESS OF GARMENT 5 Smooth appearance, no wrinkles 4 Few wrinkles 3 Moderate wrinkles 2 Many wrinkles 1 Unsightly wrinkles	
II. SEAM PUCKER 5 No seam pucker 4 Few seam puckers 3 Moderate seam puckers 2 Many seam puckers 1 Unsightly seam puckers	
III. CREASES 5 Sharp creases 4 Moderately sharp creases 3 Moderate creases 2 Poor creases 1 No creases	

FIGURE 6

SCORE CARD FOR EVALUATION OF TROUSERS ON THE WEARER BY PANEL

No. of Launderings_____ Trouser Category_____

I. SMOOTHNESS OF GARMENT 5 Smooth appearance, no wrinkles 4 Few wrinkles 3 Moderate wrinkles 2 Many wrinkles 1 Unsightly wrinkles	
II. SEAM PUCKER 5 No seam pucker 4 Few seam puckers 3 Moderate seam puckers 2 Many seam puckers 1 Unsightly seam puckers	
III. CREASES 5 Sharp 4 Good creases 3 Moderate creases 2 Poor creases 1 No creases	

FIGURE 7

SCORE CARD FOR APPEARANCE EVALUATION BY WEARER

FABRIC WEIGHT

The fabric weight was determined according to ASTM Designation: D-1910-64 (5). Three specimens 6.0 by 6.0 inches were cut from each experimental fabric. They were placed under standard conditions overnight and weighed on the Mettler Balance. The weight in ounces per square yard was calculated for each of the five experimental fabrics according to the following formula:

$$\text{Weight in Ounces Per Square Yard of Fabric} = \frac{\text{Weight in Grams} \times 45.72}{\text{Length} \times \text{Width in Inches}}$$

YARN COUNT

The yarn count of each fabric was determined according to ASTM Designation: D-1910-64 (5). The Suter Yarn Counter was used and the number of yarns in one inch squares from five areas of the fabric were counted.

TREATMENT OF DATA

A randomized block design was used as the design for the study and the data were computed by means of an analysis of variance. Significant differences between trouser types were determined at the 95 per cent confidence level by means of the Duncan's Multiple Range Test.

PRESENTATION OF DATA AND DISCUSSION OF FINDINGS

The data concerning the appearance of 200 pairs of men's worn and non-worn durable press khaki trousers representative of five fiber-fabric-finish categories initially and during 30 cycles of laundering are found in Tables I through XXV in the Appendix of this manuscript. Tables I through VII present findings concerning the smoothness of the fabrics of the experimental trousers as evaluated by standard procedures recommended by the American Association of Textile Chemists and Colorists and as evaluated during wear both by a panel of three textile members and by the wearers themselves. Values which resulted from the assessment of the creases by the procedures mentioned above are recorded in Tables VIII through XIV; whereas Tables XV XXI tabulate the seam smoothness evaluations as judged in the same manner. The apparent soil ratings, both before and after laundering, are entered in Tables XXII through XXV.

Variables such as fabric category, wear grouping, and number of launderings were analyzed statistically by means of the analysis of variance (AOV) followed by Duncan's Multiple Range Test with reference to cumulative data from

one through 10; 11 through 30; and one through 30 laundering periods, respectively. Significant differences are reported on the 95 per cent confidence level. In the following discussions, rank order arrangements of the above-mentioned variables are presented as a means of summarizing the findings of the study. These ranks are based upon the number of times each variable demonstrated a superior level of performance when statistical comparisons of the data were made. In each instance comparisons were determined directly from the mean values with regard to the consistency reflected by the standard deviations. Each statement with reference to superiority of performance represents a significant difference when statistical comparisons were made.

EVALUATION OF FABRIC SMOOTHNESS

The smoothness of the experimental fabrics was rated after each of the 30 wear and laundering cycles by a three-member panel, with the American Association of Textile Chemists and Colorists' Three Dimensional Durable Press Replicas used as standards for these ratings. At intervals of five wear periods an appraisal of the five respective types of experimental trousers was made by a panel and by the men themselves, by means of the standards shown in Figures 1 through 5 and the score cards shown in Figures 6 and 7 which were devised for this purpose. The results of these evaluations are given in Tables I through VII in the Appendix. Each rating on the tables except those

representative of the trousers as evaluated by the men is an average of the scores of three panelists for each pair of trousers in a particular category and represents 150 scores for the non-worn and 225 scores for the White Collar group and for the first 10 evaluations for the Blue Collar group. The number of scores represented by each value on the tables for the Blue Collar group from 11 to 30 wear-laundering periods ranges from 15 to 225, depending upon the number of trousers that had been withdrawn from the study due to excessive wear. Refer to Summary B for the number of trousers that remained in service at each interval of evaluation. The score card for evaluation of smoothness by the men was devised at the end of the fifth wear-laundering cycle; therefore, only one rating per pair of trousers was made for the first 10 wear-laundering periods.

A treatment of the cumulative smoothness data from one through 30 wear-laundering periods was used in the development of the rank order arrangements of the trouser types based on the number of times each demonstrated superior smoothness values when statistical comparisons were made. These comparisons were determined as described in the Introduction to this section of the manuscript.

SMOOTHNESS OF FABRICS AS EVALUATED BY MEANS OF AATCC STANDARDS

Blue Collar Group. During the first 10 wear-laundering periods the all-cotton Koratron-finished trousers (Type C) which were worn by the Blue Collar group displayed a 4.6 mean smoothness rating which was representative of a performance superior to that of the other four types of trousers when AATCC Standards were used as the evaluation means. The two types of cotton-polyester trousers (D and E) ranked second, with mean ratings of 4.4 and 4.3, respectively. Trousers of Category A, with a 3.7 rating, and those in Category B, with a value of 3.3, proved to be the most wrinkled of the lot.

The performance of trousers of the D Category improved during the last 20 laundering periods to the extent that they shared first rank with the C Trousers with respect to fabric smoothness. Category E dropped into third place but the all-cotton Types A and B trousers retained the pattern of performance which they had displayed during the earlier part of the study.

A rank order of the trousers based on a comparison of the cumulative data from one through 30 wear-laundering periods follows:

Rank	Type of Trousers
1	All-cotton (C)
1	65/35 Cotton-polyester (D)
3	50/50 Cotton-polyester (E)
4	All-cotton (A)
5	All-cotton (B)

Although trousers of Category C ranked first with respect to their smoothness throughout the 30 periods of wear and laundering, reference to Summary B reveals the fact that some bias may have entered into the ranking of the Blue Collar group of trousers. The data upon which the rankings were developed perhaps do not present a true picture of the relative smoothness performance of the five types of trousers, since fewer trousers were represented in the data for the C Category than in that for the remaining four types of trousers. Only 14 of the original 15 pairs of C Trousers remained in the study after 10 wear-laundering periods and the number dropped consistently from that period until only one pair of C Trousers was in service from 25 through 30 wear-laundering periods. Data for the last wear-laundering interval recorded in Table I were based on the score of one pair of trousers in Category C and these trousers were worn by one of the wearers of the Blue Collar group who did the less heavy type of work. Withdrawals were begun in other categories after 16 wear-laundering periods as is indicated in Summary B.

White Collar Group. During the first 10 wear-laundering periods the AATCC procedure for evaluation of fabric smoothness revealed the fact that trousers of the C, D, and E Categories worn by the White Collar group were superior to Trousers A and B in their smoothness performance as indicated by mean smoothness ratings of 4.8, 4.8, and 4.7, respectively. The smoothness of the A Trousers was equivalent to a 3.8 rating, and trousers of Category B with a 3.3 rating again were the poorest performers in every comparison in which they were involved.

As was found to be the case with the trousers worn by the Blue Collar group, data which were accumulated during the latter part of the study (from 11 to 30 laundering periods) revealed a significant improvement in smoothness ratings for all categories. The blends (Trousers C and D), with a 4.9 rating, continued to demonstrate their superior smoothness properties in relation to the remainder of the trouser types. During this period the E Trousers dropped to third rank in fabric smoothness, although they continued to display smoother properties than did Trousers A and B.

The following rank order, identical with that established for trousers worn by the Blue Collar group, evolved from the statistical analysis of the comparative smoothness performance of the white collar trousers as measured by the AATCC Standards for such evaluations:

Rank	Type of Trousers
1	All-cotton (C)
1	65/35 Cotton-polyester (D)
3	50/50 Cotton-polyester (E)
4	All-cotton (A)
5	All-cotton (B)

Non-worn Group. Intercomparisons of the data representative of the smoothness performance of the five types of Non-worn trousers revealed the fact that the all-cotton Koratron-treated fabrics (Type C), with a mean smoothness rating of 4.9 exhibited a more acceptable appearance than did the remainder of the trouser types during the first 10 laundering periods. The poorest performance was accredited to the all-cotton Trousers B, the smoothness of which was equivalent to a rating of 3.5, and intermediate positions were claimed by the two blends (Trousers D and E).

From 11 to 30 periods of laundering, the all-cotton Koratron-treated fabric and the 65/35 cotton-polyester blend exhibited excellent properties which were represented by mean smoothness ratings of 4.9. Hence they surpassed the remaining types of fabrics. Again Trousers B, with a low rating of 3.8, proved to be more prone to wrinkling.

When overall comparisons were made of the final data, the Non-worn trouser types ranked as follows with respect

to their smoothness properties as evaluated by AATCC Standards:

Rank	Types of Trousers
1	All-cotton (C)
2	65/35 Cotton-polyester (D)
2	50/50 Cotton-polyester (E)
4	All-cotton (A)
5	All-cotton (B)

Comparison of the Three Trouser Groups. The data for the Blue Collar, the White Collar, and the Non-worn trouser groups were studied for the purpose of making a comparison of their performance with reference to smoothness. Although wear before laundering affected the smoothness of the all-cotton Trousers A and B during the early part of the study (one through 10 launderings) the type of wear did not prove to be a factor. With respect to trouser types the Non-worn Trousers demonstrated the smoothest appearance, with no significant differences between the performance of the Blue and White Collar groups. This was not the case with two of the remaining types of trousers (C and E), since in these categories the smoothness of the trousers generally was related to the severity of wear to which the trousers had been subjected. In all comparisons, the White Collar trousers proved to be smoother than those worn by the Blue Collar group, with no difference between

the performance of the Non-worn Trousers and those worn by White Collar men.

Trousers D failed to conform to the performance of Trousers C and E in one respect only. The appearance of the White Collar trousers was more acceptable than that of the Non-worn group.

During the last 20 laundering periods a more definite pattern of performance prevailed for the five trouser types. In every instance the smoothness of the White Collar and the Non-worn Trousers was superior to that of the Blue Collar trousers, however, in two categories (Trousers A and B) the Non-worn Trousers were smoother than those worn by the White Collar group.

Results of comparisons which were made of the smoothness of the five types of trousers as evaluated by the AATCC standard procedures in relation to the type of wear exerted on them are shown in Figure 8. An overall ranking of the wear groups, irrespective of trouser types, was determined on the basis of the number of times a particular group excelled in fabric smoothness in the 10 comparisons to which they were subjected. These comparisons revealed the fact that the appearance of the Non-worn trousers proved to be the most desirable as was reflected by eight of the 10 comparisons. White Collar trousers ranked second with five

superior rankings, and the Blue Collar trousers were outranked in every instance.

Rank	Wear Group
1	Non-worn
2	White Collar
3	Blue Collar

SUMMARY B

NUMBER OF PAIRS OF TROUSERS OF THE BLUE COLLAR GROUP WHICH REMAINED IN SERVICE AT DESIGNATED PERIODS OF WEAR AND LAUNDERING

Trouser Types	Wear-Laundering Periods																				
	1-10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30
A (100) 100% Cotton	15	15	15	15	15	15	15	15	15	14	14	14	14	14	14	14	13	13	12	12	12
B (200) 100% Cotton	15	15	15	15	15	15	15	14	14	14	14	14	14	14	14	13	10	10	10	10	10
C (300) 100% Cotton	15	14	13	13	13	13	12	11	11	10	10	8	6	5	2	1	1	1	1	1	1
D 65/35 Cotton-Polyester	15	15	15	15	15	15	15	15	15	15	15	15	15	15	15	15	14	14	14	14	14
E 50/50 Cotton-Polyester	15	15	15	15	15	15	15	15	15	15	15	15	15	15	15	15	14	14	14	14	14

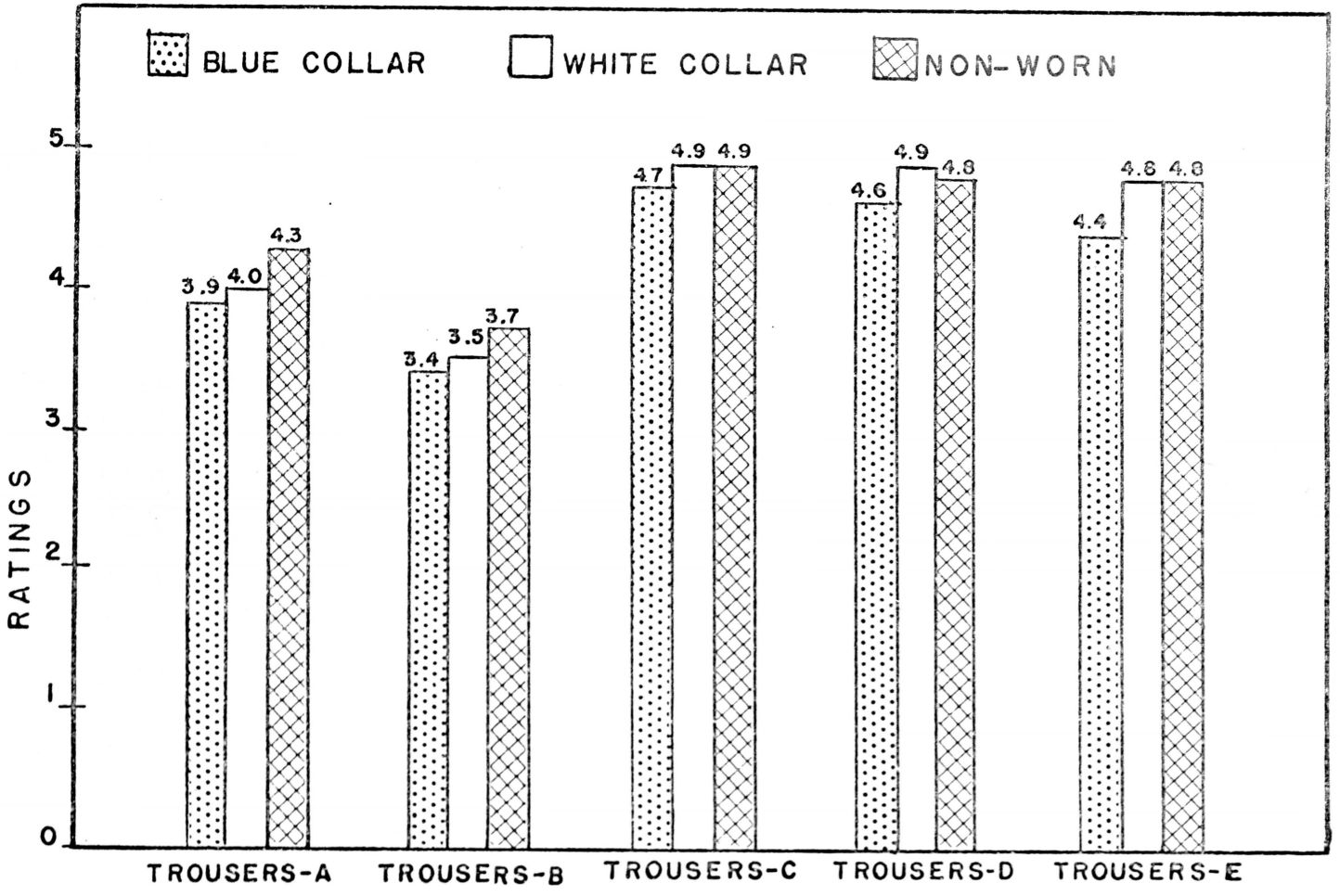

FIGURE 8

A COMPARISON OF THE OVERALL FABRIC SMOOTHNESS OF BLUE COLLAR, WHITE COLLAR, AND NON-WORN TROUSERS AS EVALUATED BY AATCC STANDARD PROCEDURES

SMOOTHNESS OF FABRICS AS EVALUATED ON THE MEN BY A THREE-MEMBER PANEL

Blue Collar Group. The trousers which were constructed of cotton-polyester blends (Types D and E), with mean smoothness ratings of 3.9 and 4.0, respectively, held first position with reference to fabric smoothness during the first 10 wear-laundering intervals as revealed by ratings on the men during each fifth wear period by a three-member panel. The comparable smoothness of the all-cotton trousers of Types A and C surpassed that of Type B which evidenced a more wrinkled appearance than that of any other type of trousers, with a low mean smoothness rating of 3.1.

Trousers of Category E remained first in rank during the last 20 wear-laundering cycles. The smoothness ratings of Category D, however, dropped to the extent that C and D were comparable and shared second rank. Category A was outranked by all trouser types except Category B, which again demonstrated the lowest smoothness ratings of the experimental trousers.

The overall ranking based on the cumulative data for the six evaluation periods when the smoothness of the trousers on the men was rated showed the following pattern which differed from that of the two appraisals given above:

Rank	Type of Trousers
1	65/35 Cotton-polyester (D)
1	50/50 Cotton-polyester (E)
3	All-cotton (C)
4	All-cotton (A)
5	All-cotton (B)

White Collar Group. An assessment of the smoothness of the White Collar trousers by the panel during wear produced results which were very similar to those found for the Blue Collar trousers. The cotton-polyester blends with the Coneprest and Lock-Prest finishes (Types D and E) with respective mean smoothness ratings of 4.1 and 4.2, both ranked first during the one through 10 wear-laundering cycles. The all-cotton Koratron-finished trousers (Type C) appeared to be somewhat smoother than the all-cotton trousers which were finished by the wet-fixation method (Type A); whereas the modified pad-dry-cure finished all-cotton trousers (Type B) produced the most wrinkled appearance as indicated by the 3.1 mean smoothness rating assigned to them by the panel in the early part of the study.

Although the mean smoothness ratings for all trousers dropped slightly during the latter evaluation period with the exception of the ratings for Type B, which held the same low value of 3.1, the values were not significantly different from those assessed during the first 10 laundering periods,

except in the case of trouser Types A and E. The same rank order that was established during the first 10 wear-laundering periods was maintained during the 11 through 30 wear-laundering cycles and again when the overall data were considered. This arrangement is shown as follows:

Rank	
1	65/35 Cotton-polyester (D)
1	50/50 Cotton-polyester (E)
3	All-cotton (C)
4	All-cotton (A)
5	All-cotton (B)

Comparison of Blue and White Collar Groups. A comparison of the data for trouser smoothness as observed by the panel when the garments were on the men revealed the finding that the severity of wear had little influence upon the ratings of trouser Types A, B, and D during the first 10 wear-laundering periods. The trousers of Categories C and E, however, were affected by the kind of wear to which they were subjected as indicated by the fact that the less strenuously worn trousers (White Collar) received smoothness ratings which were superior to those of the more harshly worn trousers (Blue Collar).

The harshness of wear appeared to have more influence on the smoothness ratings as the study progressed. During the last 20 wear-laundering periods the White Collar

group outperformed the Blue Collar group in every instance. This also proved to be the case in the overall ranking, since the White Collar group excelled the Blue Collar group in all five of the comparisons of the smooth appearance of the trousers.

SMOOTHNESS OF FABRICS AS EVALUATED BY THE MEN DURING WEAR

Blue Collar Group. At the fifth wear period, when the men themselves were asked for subjective opinions concerning the smoothness of their trousers, their answers could not be tabulated in any meaningful way. Therefore, the score card shown in Figure 7 was devised. The smoothness ratings on the score card for the tenth wear period showed no significant differences in the ratings assigned to the five respective types of trousers by the men of the Blue Collar group.

During the last 20 wear-laundering periods a drop in the mean rating of trousers of the A Category from 4.0 to 3.4 established a pattern from which a rank order for the five types of trousers could be ascertained. Trousers of the C and D Categories, with mean smoothness ratings of 3.7 and 3.8, respectively, displayed superior smoothness in comparison with that exhibited by trousers of the A and B Categories during the last 20 wear-laundering periods.

Types A and B both exhibited comparably low scores for fabric smoothness at this point in the investigation.

Trousers of Categories C and D held their position of superiority in a ranking based upon the cumulative data for the entire study for trouser smoothness as evaluated by men of the Blue Collar group. There were no significant differences resulting from this evaluation for the remaining types of trousers as is indicated by the following ranking:

Rank	Type of Trousers
1	All-cotton (C)
1	65/35 Cotton-polyester (D)
3	All-cotton (A)
3	All-cotton (B)
3	50/50 Cotton-polyester (E)

White Collar Group. The first evaluation which was made at the same stage in the study as that for the Blue Collar group involved only one assessment and revealed little difference in the opinion of the men of the White Collar group as to the smoothness of the five types of experimental fabrics. Seven of their ratings in 10 comparisons evidenced no real differences with reference to wrinkling. Trousers of Type D ranked first with a mean rating of 4.1, since they were rated superior to the all-cotton trousers in Categories A and B. The all-cotton

Type C trousers with a mean rating of 3.9 exhibited greater smoothness than did Type B trousers, as shown by a rating of 3.5.

During the last 20 wear-launderings the smoothness performance of Categories C, D, and E was rated comparably by men of the White Collar group, all of whom fell in first rank; while the all-cotton Fabrics A and B with a low mean smoothness value of 3.4 did not excel in any comparison. This rank continued to prevail when an overall comparison of the cumulative data was made as can be noted below:

Rank	Type of Trousers
1	All-cotton (C)
1	65/35 Cotton-polyester (D)
1	50/50 Cotton-polyester (E)
4	All-cotton (A)
4	All-cotton (B)

Comparison of Blue and White Collar Groups. When the opinions of the Blue Collar group concerning fabric smoothness were compared to the opinions of the White Collar men at all three periods of analysis, namely after 10, from 11 through 30, and from 10 through 30 wear-laundering cycles, no significant differences were observed between the men with respect to the type of wear to which they were subjected.

COMPARISON OF THE THREE EVALUATION METHODS FOR FABRIC SMOOTHNESS

A statistical analysis of the cumulative data from one through 30 wear-laundering periods was made for all types of trousers with reference to fabric smoothness, for the purpose of comparing the results obtained from the evaluations made according to AATCC Standards with those made concerning appearance during wear on the men as rendered by the panel and with those made by the participants themselves.

The mean smoothness rating of 4.2 assigned to the White Collar group by means of the AATCC Standards was significantly higher than the 3.4 rating received by the trousers when evaluations were made by the panel with the garments on the men during wear and by the men themselves. White Collar participants whose opinion of fabric smoothness was rated at 3.7, evaluated the appearance of the trousers higher than did the panel. This difference probably was due to the amount of wrinkling which resulted from wear, since the AATCC evaluation procedure measured only wrinkling resulting from the laundering procedures. The above mentioned values also indicate that the ratings during wear by the men were higher than those given by the panel.

A similar pattern to that mentioned above existed for the trousers worn by the Blue Collar men when the three

evaluation procedures for fabric smoothness were compared, except for the fact that an identical mean value of 3.7 was assigned by both procedures which were used for the rating of the trousers on the men.

SHARPNESS OF PRESSED-IN CREASES

A tabulation of the sharpness of the pressed-in creases appears in Tables VIII through XIV in the Appendix of this dissertation. Data which resulted from the evaluations of the experimental trousers after each of the 30 wear and laundering cycles by a three-member panel, with the AATCC Standards used as a basis for the ratings are recorded after each fifth laundering interval in Tables VIII through X. Tables XI and XII give similar results of evaluations made by the panel on the men during wear, while the opinions of the men concerning the sharpness of their creases appeared in Tables XIII and XIV. With the exception of the participants' ratings, each value on the tables represents an average of the scores of the three panelists for each pair of trousers in a particular category, and represents 225 scores for the White Collar group and varying numbers of scores for the Blue Collar group dependent upon the number of trousers still in service at that time. (See Summary B.) The rank orders presented herein were based on the treatment of data as explained in the introduction to this section.

SHARPNESS OF CREASES AS EVALUATED BY MEANS OF AATCC STANDARDS

Blue Collar Group. The all-cotton Koratron trousers (Type C) worn by the Blue Collar group led in crease sharpness after the first 10 evaluation periods, as is evidenced by a mean crease rating of 4.3. The trousers finished by the wet-fixation process (Type A) had more pronounced creases than did the remaining three types of trousers. A comparable crease performance was demonstrated by Trousers B and E, while a mean crease rating of 2.7 placed the D Trousers in the poorest position with respect to crease sharpness during the early evaluations.

Type C held its position of crease superiority during the last 20 wear-laundering periods, while the sharpness of the creases in Type A trousers deteriorated to a low level of 2.7. This rating proved to be no better statistically than the creases which were displayed by the trousers constructed from the blended fabrics (Trousers D and E). Trousers in the B category exhibited the poorest creases during this period as indicated by the low rating of 2.3.

The sharpness of the creases for the Blue Collar group based on the cumulative data from one through 30 wear-laundering periods ranked as shown below:

Rank	Type of Trousers
1	All-cotton (C)
2	All-cotton (A)
2	65/35 Cotton-polyester (D)
2	50/50 Cotton-polyester (E)
5	All-cotton (B)

As was believed to be the case with the comparative performance of the trouser types with respect to their smoothness, there are indications that bias entered into these rankings because of the number of specimens upon which the data were based. See Summary B for the number of trousers of each type which were evaluated at the respective intervals.

White Collar Group. A study of the data representative of trousers worn by the White Collar work group revealed the fact that the sharpest creases were found in Trousers C as indicated by the mean rating of 4.6 after the first 10 periods of evaluation. The 50/50 blend (Trousers E) ranked second with a rating of 3.4, while the creases for Categories A, B, and D were comparable with ratings which ranged from 3.0 to 3.2.

A further study of the data shows that, despite the fact that the mean crease ratings for all categories of trousers worn by the White Collar participants, except those

of Type D, decreased as wear-launderings progressed from 11 through 30. The same ranks which had been established during the early part of the study persisted with one exception. The sharpness of the creases of the all-cotton trousers in Category B was reduced, as indicated by a mean crease rating of 2.5. As a result, these trousers were considered to be the poorest performers of the group.

When the data for the entire study were evaluated with respect to crease performance, the following results, which were identical with those described above for the last 20 wear-laundering periods, were obtained:

Rank	Type of Trousers
1	All-cotton (C)
2	50/50 Cotton-polyester (E)
3	All-cotton (A)
3	65/35 Cotton-polyester (D)
5	All-cotton (B)

Non-worn Group. As proved to be the case with the worn trousers, the Non-worn all-cotton Koratron treated trousers (Type C) exhibited the sharpest creases, with a mean rating of 4.6 during the first 10 launderings. Trousers of the A and E Categories shared second place at this point in the study, and the fabrics of the B and D Trousers demonstrated less ability to hold sharp creases, as was

indicated by the low mean crease ratings of 3.2 and 3.1, respectively.

During the 11 through 30 wear-laundering periods, trousers of Categories A, B, and E showed lower crease sharpness than those exhibited during the first evaluation periods. Category E, however, showed sharper creases than did Category A and replaced it in second rank. A pattern similar to that of the first 10 laundering periods prevailed for the remaining types. There were no significant differences noted in the performance of Categories C and D.

The rank order for the crease sharpness of the Non-worn trousers based on the cumulative data from one through 30 wear-launderings developed as follows:

Rank	Type of Trousers
1	All-cotton (C)
2	50/50 Cotton-polyester (E)
3	All-cotton (A)
4	All-cotton (B)
4	65/35 Cotton-polyester (D)

Comparison of the Three Trouser Groups. The data for the Blue Collar, the White Collar, and the Non-worn trouser groups were studied for the purpose of comparing their crease performances. The sharpness of the creases of the all-cotton A and B trousers was affected by wear by

both the Blue and White Collar participants during the first 10 launderings. There were no differences attributed to the type of wear. The Non-worn trousers in these categories exhibited sharper creases than either sets of the trousers worn by the White or Blue Collar groups. This was not the case with the three remaining types of trousers (Types C, D, and E). In these categories, the sharpness of the creases was affected by the rigorousness of the wear to which the trousers had been subjected. Creases in the trousers worn by the White Collar men were sharper than the Blue Collar creases in all three comparisons, while no differences were observed between the performance of the White Collar and the Non-worn groups.

During the last 20 laundering periods, the severity of wear proved to be a prevailing factor for crease performance. The Blue Collar crease sharpness was surpassed in every instance by the White Collar and the Non-worn groups. The Non-worn group had sharper creases than did the White Collar group except in two categories (C and D) where there were no significant differences in the performance of the trousers in these two groups.

Comparisons made from the cumulative data (one through 30 launderings) revealed the same pattern of performance for all five types of trousers as was demonstrated during the last 20 laundering periods. These results are diagramatically sketched in Figure 9.

An overall ranking of the wear groups without regard to trouser types was determined on the basis of the number of times a particular group exhibited the sharpest creases in the 10 comparisons to which they were subjected. The Non-worn trouser creases proved to be the most acceptable in eight of their 10 comparisons. The White Collar trousers ranked second with five superior ratings while the Blue Collar group showed no superior ratings in any instance of comparison as is noticeable in the rank order arrangement given below.

Rank	Wear Group
1	Non-worn
2	White Collar
3	Blue Collar

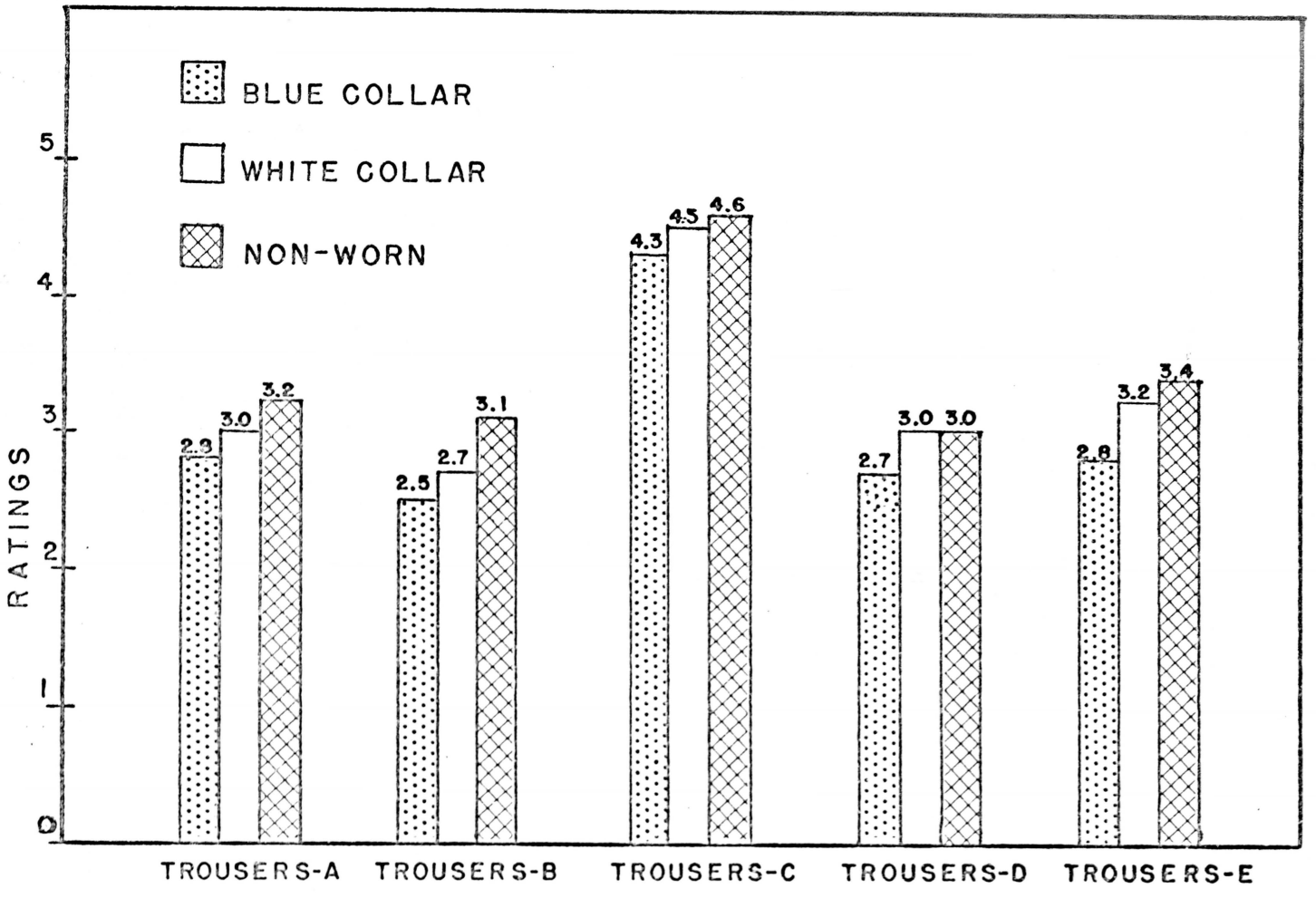

FIGURE 9

A COMPARISON OF THE OVERALL CREASE SHARPNESS OF BLUE COLLAR, WHITE COLLAR, AND NON-WORN TROUSERS AS EVALUATED BY AATCC STANDARD PROCEDURES

SHARPNESS OF CREASES AS EVALUATED ON THE MEN BY A THREE-MEMBER PANEL

Blue Collar Group. When the sharpness of the creases in the trousers of the five experimental fabrics was judged on the men of the Blue Collar group by the panel, it was noted readily that the all-cotton Koratron-finished trousers, with a rating of 4.2, maintained the sharpest creases during wear after the first 10 evaluation periods. These trousers were followed in rank by the two blends with the Coneprest and Lock-Prest finishes (Types D and E) with respective values of 3.6 and 3.9. There were no significant differences in the sharpness of creases for the other two all-cotton trousers (Types A and B) although a mean crease rating of 3.1 by B proved to be the lowest value given to any category.

Despite the fact that all ratings dropped during the last 20 wear-laundering cycles, the same rank was maintained for all of the respective types, with the exception of the B Trousers the crease sharpness of which, with a rating of 2.3, was no longer comparable to the A Trousers. This same rank order prevailed in an overall comparison of the data as may be observed by the following arrangement of the various types of trousers:

Rank	Type of Trousers
1	All-cotton (C)
2	50/50 Cotton-polyester (E)
3	65/35 Cotton-polyester (D)
4	All-cotton (A)
5	All-cotton (B)

White Collar Group. As in previously discussed assessments, Type C all-cotton trousers maintained sharper creases during wear by the White Collar group in the opinion of the panel who assigned a mean rating of 4.0 to this classification of trousers after 10 periods of wear and laundering. The trousers of Category E followed closely behind with a rating of 3.8 for second rank, while the 3.6 rating for Category D exhibited sharper creases than either of the other types of all-cotton trousers (A and B). The lowest rating obtained was 2.8 for the all-cotton trousers of Category B.

The ratings for crease sharpness for all categories dropped during the 11 through 30 wear-laurdering cycles. This drop was non-significant, however, for the cotton-polyester trousers (Type D) which made its rank comparable to that of the other blend (Type E). The poorest creases again were observed in the all-cotton trousers of the A and B Categories.

In the overall comparisons the following order of performance prevailed for the five respective types of fabrics:

Rank	Type of Trousers
1	All-cotton (C)
2	65/35 Cotton-polyester (D)
2	50/50 Cotton-polyester (E)
4	All-cotton (A)
5	All-cotton (B)

Comparison of Blue and White Collar Groups. The effect of the degree of wear on the sharpness of creases as viewed on the men by the panel failed to form a definite pattern of any consistency at any of the evaluation periods. During the first 10 evaluations the only significant difference observed was in sharper creases for Category C trousers worn by the Blue Collar group.

This difference was not manifested during the last 20 launderings. At this time, however, the creases of the White Collar group were judged to be superior to those of the Blue Collar group in the case of Categories B, D, and E.

The cumulative data from one to 30 wear-laundering periods showed no differences in the ratings between the two wear groups for Categories A, B, and C with reference to their crease performance, although the creases in Trousers

D and E of the White Collar group were sharper than those of the Blue Collar group.

SHARPNESS OF CREASES AS EVALUATED BY THE MEN DURING WEAR

Blue Collar Group. The sharpness of creases as evaluated by the men of the Blue Collar group through the tenth wear-laundering period was based on one score only, as mentioned previously, since the score card was not devised until after the first five wear-laundering intervals. The opinions of the men concerning the sharpness of the creases of the various experimental trousers reflected no significant differences between the five trouser types during this first period.

A definite ranking was evident during the last 20 launderings which was similar, although not identical, to the rankings made by the panel. The all-cotton Koratron-finished trousers (Type C) with a mean crease rating of 3.8 displayed the sharpest creases and out-ranked all four of the other types of trousers. The 3.5 ratings of Categories D and E were superior to the ratings of the all-cotton Categories A and B as depicted by the low mean crease ratings of 3.1 and 3.1, respectively.

The following rank order identical to that of the 11 through 30 wear-laundering periods evolved from the

statistical analysis of the comparative performance of the creases of the Blue Collar trousers:

Rank	Type of Trousers
1	All-cotton (C)
2	65/35 Cotton-polyester (D)
2	50/50 Cotton-polyester (E)
4	All-cotton (A)
4	All-cotton (B)

White Collar Group. Trousers of the C, D, and E Categories were felt to be comparable in their crease sharpness in the opinion of the wearers of the White Collar group who gave them respective mean ratings of 3.9, 4.1, and 3.8 after the first 10 wear-laundering periods. As in previous instances, Categories A and B showed no differences between their performance; and they did not out-rank any other category, as shown by their low ratings of 3.4 and 3.1.

The opinions of the participants of the White Collar group were consistent at every phase of the evaluation concerning the sharpness of the creases. The rank established during the first evaluation was maintained during the last 20 launderings and again when the cumulative data for the entire study were analyzed as shown below. The ratings for the D trousers dropped somewhat during the last 20 wear-laundering periods but not to the extent that the ranking

was affected. There were no significant differences in the ratings of any of the other types of trousers from the first to the last evaluation periods.

Rank	Type of Trousers
1	All-cotton (C)
1	65/35 Cotton-polyester (D)
1	50/50 Cotton-polyester (E)
4	All-cotton (A)
4	All-cotton (B)

Comparison of Blue and White Collar Groups. When statistical comparisons were made of the crease ratings given the five trouser types by the participants of the Blue Collar group with those of the White Collar men there were no significant differences noted between the values given the groups at any of the three periods of data analysis.

COMPARISON OF THE THREE EVALUATION METHODS FOR THE SHARPNESS OF CREASES

Comparisons were made of the cumulative crease data obtained by use of the AATCC Standards with those obtained by a panel and by the wearers themselves as the trousers were worn from one through 30 wear-laundering periods for the various types of experimental fabrics employed in the

study. These comparisons revealed the fact that ratings by AATCC Standards were comparable to the ratings by the panel when the trousers were rated on the men of the White Collar group, since a value of 3.3 was assigned in each evaluation.

The men of the Blue Collar group rated the sharpness of the creases in their trousers (3.4) higher than did the panel either by AATCC Standards (3.0) or by the panel viewing the trousers on the men (3.1). As can be noted, the creases had a slightly sharper appearance on the men of the Blue Collar group during wear than when evaluated in the laboratory before wear under AATCC Standards.

APPEARANCE OF SEAMS

Tables XV through XXI in the Appendix depict the results of the evaluations of the smoothness of the seams of the five types of experimental trousers. These evaluations were made by a three-member panel after each of the 30 wear-laundering cycles according to AATCC Standards and also by a panel and by the wearers themselves during each fifth wearing interval, as described in the section on Procedures. The number of trousers involved in each phase of this evaluation is shown in Summary B and the number of scores and the treatment of data are identical with the description in the section devoted to fabric smoothness.

It is possible that this evaluation reflects more of the efficiency of the construction procedures than of the fabric finishes, since there appears to be a relationship of seam smoothness to construction methods. Also, the fact that three manufacturers were involved in the production of the trousers added another variable that could lend bias to the results.

SMOOTHNESS OF SEAMS AS EVALUATED BY MEANS OF AATCC STANDARDS

Blue Collar Group. During the first 10 periods of evaluation the trousers constructed of fabrics of the two blend levels of cotton-polyester (Type D with the Coneprest finish and Type E with the Lock-Prest finish) exhibited superior seam smoothness to that of the three types of all-cotton trousers as is exemplified by a mean seam rating of 4.5 and 4.4, respectively.

In a comparison of the all-cotton trousers, the Koratron-finished (Type C) trousers proved to have smoother seams than did the two remaining types (A and B). Trousers of Type A exhibited the greatest degree of puckering as indicated by a low mean seam rating of 3.6.

The seams of all categories of trousers, with the exception of Type D, became progressively more puckered

with additional wear-laundering periods. This resulted in a drop in rank for Category E which placed it in second position. All three types of all-cotton trousers maintained the same rank placement that they held during the first evaluation period.

The comparative order established for the five trouser types during the last 20 wear-laundering periods persisted, as can be noted below, when an analysis of the cumulative data was made with respect to the seam smoothness of the trousers worn by the Blue Collar men.

Rank	Type of Trousers
1	65/35 Cotton-polyester (D)
2	50/50 Cotton-polyester (E)
3	All-cotton (C)
4	All-cotton (B)
5	All-cotton (A)

White Collar Group. The superior performance of the Coneprest-finished 65/35 cotton-polyester trousers (Type D) with reference to the smoothness of the seams was evidenced in the trousers worn by the White Collar group during the early evaluations of the study, as measured by a mean value of 4.6 for seam smoothness. Trousers of all-cotton with a Koratron finish (Type C) and the 50/50 blend with the Lock-Prest finish (Type E) shared in second rank with values of

4.3 and 4.2, respectively. The all-cotton Type B classification showed slightly smoother seams than did Type A, which was identical for the Blue Collar group having a mean rating of 3.6 for the first 10 wear-laundering intervals.

Although the seam smoothness of Type D trousers improved during the last 20 launderings and the ratings for all other trouser types dropped to some extent, the ranking of the White Collar trousers in relation to their seam smoothness remained the same at each assessment period, irrespective of the number of wear-laundering cycles to which they had been subjected. These rankings are indicated by the following arrangement:

Rank	Type of Trousers
1	65/35 Cotton-polyester (D)
2	All-cotton (C)
2	50/50 Cotton-polyester (E)
4	All-cotton (B)
5	All-cotton (A)

Non-worn Group. In the comparisons of seam smoothness from one through 10 laundering intervals for the Non-worn trousers, first rank was shared by the cotton-polyester blend trousers with the Coneprest finish (Type D) and the all-cotton Koratron-finished trousers (Type C) with mean seam values of 4.5 and 4.4, respectively. The ratings of

4.2 and 4.1 which were assigned to the trousers of Categories E and B placed these trousers in a close second and third position. The all-cotton trousers (Type A) exhibited the most undesirable seam lines with a low mean rating of 3.9 attributed to them.

As the laundering periods progressed, the seams of the all-cotton categories became progressively more puckered. This resulted in a shift in rank for Category C which placed only the trousers of Category D in a position of superior rank.

In a cumulative comparison of the data for the entire study, the following order of performance prevailed for the five respective types of fabrics:

Rank	Type of Trousers
1	65/35 Cotton-polyester (D)
2	All-cotton (C)
2	50/50 Cotton-polyester (E)
4	All-cotton (B)
5	All-cotton (A)

Comparison of the Blue Collar, White Collar, and Non-worn Trousers. The smoothness of the seams of all three classifications of all-cotton trousers was affected by wear during the first 10 laundering periods as indicated by the superior performance of the Non-worn trousers in this

respect. The severity of wear did not appear to be a factor since no differences were noted between the smoothness of the White Collar and the Blue Collar groups at this time. The seams of the 65/35 cotton-polyester Trousers D reacted in a different manner to wear and laundering to that described above. Although the seams in the trousers worn by the White Collar group were smoother than those of the Blue Collar group, no differences were observed between the trousers of either of the worn groups and the non-worn trousers in this category. The behavior of Category E was found to be unique in that the seam smoothness of the Blue Collar group, which experienced harder wear, excelled over the performance of the Non-worn and White Collar groups; while a comparable performance of the Non-worn and the White Collar trousers was noted.

During the last series of evaluations (11 to 20 periods of wear-laundering) the trousers which received the hardest wear displayed the smoothest seams in two instances (Types A and E). No significant differences were noted in the smoothness of the seams of the all-cotton trousers of Category B, irrespective of type of wear. Generally, the same patterns occurred as in the earlier evaluations for Categories C, D, and E.

Comparisons which were made from the cumulative data (one through 30 launderings) revealed an erratic

behavior pattern within the five respective trouser categories, with little resemblance to either of the evaluation periods previously discussed in relation to the effect of the type of wear upon the smoothness of seams. Figure 10 illustrates the relative performance of the seams for each trouser category. Irrespective of the type of trousers, the overall analysis revealed the fact that, in seven of the 10 comparisons, the seams of the non-worn trousers were superior. The Blue Collar group showed smoother seams than did the White Collar group for Category A and better than the White Collar and the Non-worn classifications for Category E. The White Collar group excelled only in one instance, which was over the D Category of the Blue Collar group. The rank order evolving from this assessment follows:

Rank	Wear Group
1	Non-worn
2	Blue Collar
3	White Collar

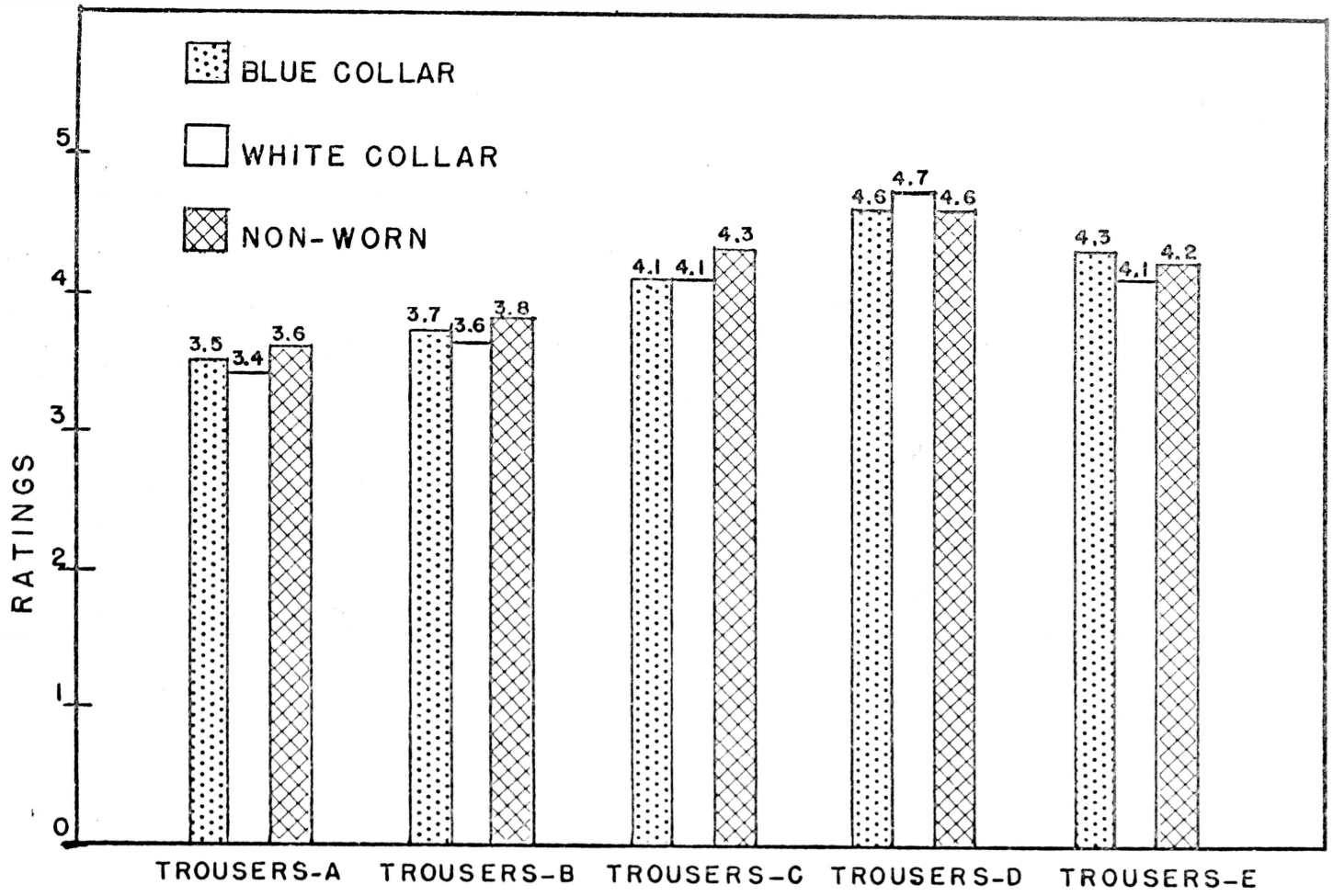

FIGURE 10

A COMPARISON OF THE OVERALL SEAM SMOOTHNESS OF BLUE COLLAR, WHITE COLLAR, AND NON-WORN TROUSERS AS EVALUATED BY AATCC STANDARD PROCEDURES

SMOOTHNESS OF SEAMS AS EVALUATED ON THE MEN BY A THREE-MEMBER PANEL

Blue Collar Group. During the first 10 wear-laundering periods the smoothness of the seams of the 65/35 cotton-polyester trousers (Type D) proved to be superior in every comparison to those of the other trousers in this study, as was shown by the mean seam smoothness rating of 4.6. The 4.2 rating for the all-cotton Koratron trousers (Type C) was followed closely by the 50/50 cotton-polyester trousers (Type E) with a rating of 4.0. Comparable ratings of 3.8 were shared by the other all-cotton trousers (Types A and B).

An increase in the mean smoothness rating for trousers constructed of cotton-polyester blends (Types D and E) was observed with 4.7 and 4.3 values, respectively, assigned for the last 20 wear-laundering periods. There was no change in the ratings of Categories A and B.

The following rank order which was established during the last 20 launderings also prevailed when the overall data were considered on the basis of the number of times the seams of a particular type of trousers performed in a superior manner to those of another type.

Rank	Type of Trousers
1	65/35 Cotton-polyester (D)
2	All-cotton (C)
2	50/50 Cotton-polyester (E)
4	All-cotton (A)
4	All-cotton (B)

White Collar Group. A mean rating of 4.2 for the Type D trousers represented the highest value assigned to the White Collar trouser group for seam smoothness during the first period of evaluation, while the 3.9 rating for Type C placed these trousers in second position with reference to seam smoothness. Ratings of 3.8 and 3.6, respectively, for trousers of the B and E categories were comparable, when statistical methods of analysis were applied to the data and the trouser types were ranked on this basis. The low rank, represented by a mean seam smoothness rating of 3.3, was assigned to the all-cotton trousers of Category A.

During the last period of evaluation a drop in the mean seam value for the trousers of the B Category to 3.4 caused their seam smoothness no longer to be comparable to that of the E Category which exhibited a mean rating value of 4.0 at this period. The pattern established here may be observed by the following rank order arrangement of the

five trouser types with reference to their seam performance throughout the entire study:

Rank	Type of Trousers
1	65/35 Cotton-polyester (D)
2	50/50 Cotton-polyester (E)
3	All-cotton (C)
4	All-cotton (B)
5	All-cotton (A)

Comparison of the Blue and White Collar Groups. In a comparison of the seam smoothness rating of the trousers of the Blue Collar group with that of the White Collar group for each trouser type, at each stage of the evaluation, the trousers of the Blue Collar group had higher mean seam smoothness ratings than those of the White Collar group. The differences were statistically significant in every instance except at the first evaluation for the B trousers. Perhaps this was caused by the fact that, as the Blue Collar trousers received more rigorous laundry treatment to remove the heavy soil, a greater amount of shrinking occurred which could have caused less pucker in the seam lines.

SMOOTHNESS OF SEAMS AS EVALUATED BY THE MEN DURING WEAR

Blue Collar Group. The opinions of the men of the Blue Collar group concerning the smoothness of the seams of

the respective experimental trousers which they wore at the first period of evaluation revealed no statistically significant differences in the performance of any of the trouser types.

During the last 20 launderings the wearers of this group gave first rank for seam smoothness to the trousers of Category D. The rating of 4.1 for this category was followed closely by a 4.0 rating for Category C. Ratings of 3.6 and 3.7 for Categories B and E, respectively, resulted in a shared position of third rank. Category A had the greatest degree of puckering in the seams as was indicated by their low mean rating of 3.4.

Overall comparisons showed D and C to be comparable in first rank and A, B, and E to be comparable in third rank as is shown below:

Rank	Type of Trousers
1	65/35 Cotton-polyester (D)
1	All-cotton (C)
3	All-cotton (A)
3	All-cotton (B)
3	50/50 Cotton-polyester (E)

White Collar Group. A range in scores from 4.2 to 3.8 for seam smoothness as the trousers were rated by men of the White Collar group for the first evaluation proved

to be non-significant, when statistical comparisons were made.

The opinions of the wearers placed the trousers of Categories C, D, and E in a comparable position as measured by mean seam ratings of 3.8, 3.8, and 3.9, respectively; whereas the all-cotton trousers of Categories A and B both were given the assessed value of 3.4 for a comparable low position in rank. The same rank order as that described above was found in the analysis of the cumulative data as can be noted in the following arrangement:

Rank	Type of Trousers
1	All-cotton (C)
1	65/35 Cotton-polyester (D)
1	50/50 Cotton-polyester (E)
4	All-cotton (A)
4	All-cotton (B)

Comparison of Blue and White Collar Groups. Very few differences of any significance were noted in the opinions of the wearers concerning the seam smoothness performance of the various types of trousers in a comparison of the data for each of the evaluation periods.

During the first evaluation, there were no differences observed in the opinions of the men of either of the wear groups with respect to seam smoothness performance of

all five types of trousers. The men of the Blue Collar group rated the seam smoothness of their trousers of Category D higher than the White Collar group rated the seams of the comparable trousers during the last 20 launderings.

In the overall assessment, the Blue Collar group rated the seam smoothness of their trousers of the B and D Categories higher than the White Collar group rated their trousers of those respective groups.

COMPARISON OF THE THREE EVALUATION METHODS FOR THE SMOOTHNESS OF SEAMS

The three methods of evaluation for the smoothness of seams were compared by means of a statistical comparison of the cumulative data from one through 30 wear-laundering periods.

The AATCC evaluations for seam smoothness of the trousers of the Blue Collar group resulted in a value of 4.0. This score was not as high as the 4.1 rating assigned by the panel to this group for seam smoothness; neither was the 3.8 rating given the trousers by the men themselves as high as the panel rating during wear.

The 4.0 overall seam smoothness rating for the White Collar group which was assessed by means of the AATCC

procedure was significantly higher than either of the types of evaluations made during wear. With reference to seam evaluations which were made while the trousers were being worn by the men of the White Collar group, one method proved to be as efficient as the other as ratings of 3.8 by the panel and 3.7 by the men indicated.

EVALUATION OF APPARENT SOIL

The amount of soil accumulated by each pair of the worn trousers was determined both before and after the laundering process as described in the Plan of Procedure for this study. Tables XXII through XXV in the Appendix tabulate these findings in mean values representative of all the trousers in the respective categories before and after each five wear-laundering cycles. In the case of the White Collar group, when the 15 pairs of experimental trousers of each type remained in service throughout the study, this value represents 75 scores. As trousers of the Blue Collar group were withdrawn because of excessive wear, at various intervals from 11 to 30 wear-laundering periods, the values for this group progressively represented fewer scores. Summary B shows the number of trousers in service at each of the respective wear-laundering intervals.

SOILING BEFORE LAUNDERING

Blue Collar Group. During the first 10 wear-laundering periods the trousers of the Blue Collar group

experienced heavy soiling as was evidenced by the soil values which were assigned them. As the wear-laundering periods progressed, the soil ratings for Categories B and C did not change significantly. The soil values for Categories A and E, however, dropped to 2.2 and those for Category E dropped to 2.3 during the 11 through 30 evaluations. The amount of soil on the various trousers was not significantly different at any stage of the evaluation or between any of the respective trouser types. No differences in the ratings resulted in the following rank order:

Rank	Type of Trousers
1	All-cotton (A)
1	All-cotton (B)
1	All-cotton (C)
1	65/35 Cotton-polyester (D)
1	50/50 Cotton-polyester (E)

White Collar Group. The amount of soil on the White Collar trousers was found to be relatively light during the first series of evaluations, with ratings ranging from 3.7 to 3.9. The only differences of significance which were observed at this time concerned the trousers of Category D which appeared to be more soiled than did the trousers of Categories A and C.

During the last 20 wear-laundering periods, soil ratings ranged from 3.4 to 3.7, which indicated that the

trousers accepted more soil with continued use. This was particularly true of Trousers A and C. The trousers of Category D exhibited more soiling than all of the other trouser types.

The cumulative data from one through 30 periods of use showed the same range of values and rankings as were noted for the last 20 wear-laundering periods. The overall rank-order for soil of the White Collar group was as follows:

Rank	Type of Trousers
1	All-cotton (A)
1	All-cotton (B)
1	All-cotton (C)
1	50/50 Cotton-polyester (E)
5	65/35 Cotton-polyester (D)

Comparison of Blue and White Collar Groups. In a comparison of the soil ratings for the Blue Collar and White Collar groups before laundering, the White Collar group of trousers of all five types proved to be the least susceptible to soiling irrespective of the stage at which the data were analyzed. These findings were expected, since the work of the White Collar group involved exposure to less soil than that of the Blue Collar group.

SOILING AFTER LAUNDERING

Blue Collar Group. The soil ratings for the trousers of the Blue Collar men after the first 10 laundering periods

ranged from 3.7 to 3.9, and revealed the fact that all of the soil failed to be removed from the trousers by the laundering formula used in the study. None of these scores were significantly different for any trouser type when comparisons were made of the various categories after the first 10 periods of evaluation.

During the 11 through 30 wear-laundering cycles scores ranged from 3.2 to 3.5. The only real difference between trouser types with reference to cleanliness was observed when values of the C Trousers were found to be higher than those for the D Category. A comparison of the soil ratings from one through 30 launderings ranged from 3.4 to 3.6, when Type C trousers demonstrated a superiority over Type D trousers. Many of the trousers of the C type for the Blue Collar group which received the hardest wear were withdrawn. Hence progressively fewer of those garments remained in service as the study neared the end. Perhaps this difference created a bias in the findings of these trousers for the Blue Collar group.

Rank	Type of Trousers
1	All-cotton (C)
2	All-cotton (A)
2	All-cotton (B)
2	65/35 Cotton-polyester (D)
2	50/50 Cotton-polyester (E)

White Collar Group. The soil ratings after laundering for the trousers of the White Collar group ranged from 4.1 to 4.6 after the first 10 periods of evaluation. Trouser Types A and B had higher mean soil ratings at this time than did trousers of Type D, whereas all other categories were comparable.

During the next 20 wear-laundering intervals the soil values dropped to ratings which ranged from 3.8 to 4.2. The performance of all groups with respect to soiling was comparable with the exception of Category D which exhibited a greater degree of soiling than did any of the other trouser types.

The overall ranking with reference to soiling based on an analysis of the data for the White Collar group for the entire study appear below:

Rank	Type of Trousers
1	All-cotton (A)
1	All-cotton (B)
1	All-cotton (C)
1	50/50 Cotton-polyester (E)
5	65/35 Cotton-polyester (D)

Comparison of Blue and White Collar Groups. Identical performance was found in the comparisons of ratings after laundering with those observed before laundering. In

every instance the White Collar group had better ratings for soiling than those which were assigned to the Blue Collar group.

COMPARISON OF SOILING BEFORE AND AFTER LAUNDERING

In every comparison of the trousers, irrespective of category, wear group, or stage of the evaluation, mean soil ratings, without exception, were consistently higher after laundering than they were before laundering. This finding indicates some measure of efficiency for the soil releasing properties of the fabrics and for the laundering procedures which were employed.

SUMMARY

Two hundred pairs of men's khaki durable press trousers of five fabric-fiber-finish categories were evaluated with reference to their appearance during 30 cycles of wear and laundering. Three of these trouser types, which were constructed of a 3/2 twill fabric of 100 per cent cotton, differed only in the type of experimental durable press finish which had been applied to them. They were designated as Types A, B, and C. The other two categories, designated as D and E, were 3/1 twills of 65/35 cotton-polyester finished with Coneprest III and 50/50 cotton-polyester finished with Lock-Prest treatments, respectively.

A set of five pairs of trousers representative of the five categories was issued to each of the 15 workmen designated as the Blue Collar group and to each of the 15 professional men assigned to the White Collar group who wear-tested the trousers for a period of 30 eight-hour wear-laundering cycles. Fifty pairs (10 from each category) were laundered without being worn.

Assessment of the amount of soil on the worn garments was made before and after each laundering period. The trousers were laundered at the regular cotton cycle in a Whirlpool washer, and thereafter tumble dried.

The fabric smoothness, sharpness of creases, and smoothness of seams were evaluated after each wear-laundering cycle by a three-member panel according to AATCC Standard Procedures. During each fifth wear period the panel judged these same factors with the trousers on the men with the assistance of a set of photographic standards which were devised by the investigators for this purpose. The wearer also recorded his opinion of the appearance of his trousers on a score card at this time. The data were computed by means of an analysis of variance (AOV) and significant differences between trouser types were determined at the 95 per cent confidence level by means of Duncan's Multiple Range Test. Ranks were based upon the number of times each variable demonstrated a significant difference in the level of performance.

EVALUATION OF FABRIC SMOOTHNESS

The overall comparisons for fabric smoothness as evaluated by the AATCC Standard Procedures for the 30 wear-laundering cycles revealed the fact that the type of wear to which the trousers were subjected had no effect on the smoothness ranking of the five trouser fabrics, since the same rank order evolved for both the White and Blue Collar groups. The all-cotton Koratron-finished (Type C) and the 65/35 cotton-polyester Coneprest-finished (Type D) trousers were comparable with reference to their smoothness performance and shared first rank. The trousers constructed of

50/50 cotton-polyester blend (Type E) were in third position, and the remaining all-cotton trousers (Types A and B) exhibited the greatest lack of smoothness and ranked fourth and fifth, respectively.

The only difference observed in the smoothness ratings for the Non-worn trousers was the fact that the trouser Types D and E shared second position. All other Non-worn trousers ranked in the same positions as did the worn trousers.

In a comparison of the performance of the three groups of trousers irrespective of type the Non-worn trousers demonstrated smoothness ratings which were superior to the worn trousers, while the White Collar trousers were smoother than those worn by the Blue Collar men.

The rank order for the smoothness of the Blue Collar trousers was identical to that for the White Collar group when the panel assessed the smoothness of the trousers on the men during wear. Trousers D and E were assigned first rank while the three all-cotton Trousers C, A, and B ranked third, fourth, and fifth, respectively. The smoothness of the experimental trousers was affected by the harshness of the wear to which they were subjected; for although both groups had the same overall ranking of the trouser types with reference to fabric smoothness, the values assigned to

the White Collar group were higher than those assigned to the Blue Collar group in every instance.

The men of the Blue Collar group rated their trousers in Categories C and D first with respect to fabric smoothness and gave comparable assessments of smoothness to Trousers A, B, and E, which placed them in third position. In the opinion of the White Collar group, Trousers C, D, and E ranked first in smoothness, while A and B ranked fourth with comparable smoothness ratings.

When the opinions of the Blue Collar wearers concerning the performance of their trousers were compared to the opinions of the White Collar group irrespective of trouser type no significant differences were observed with respect to the type of wear to which the trousers were subjected.

A comparison of the overall results obtained from evaluations made by AATCC Standard Procedures with those made by the panel during wear and those of the participants themselves revealed the fact that higher ratings were assigned to the White Collar group by the AATCC Standards than was found by the panel during wear. A similar pattern to that mentioned above emerged for the Blue Collar trousers when the three evaluation procedures for fabric smoothness were compared, except for the fact that the panel and the

men gave identical ratings for the trousers on the men during wear.

SHARPNESS OF PRESSED-IN CREASES

The creases were sharpest in the all-cotton Koratron-treated Trousers C when evaluations were made according to AATCC Standard Procedures for the Blue Collar group. Categories A, D, and E ranked second in this respect while Trousers B exhibited the poorest creases.

The White Collar all-cotton Koratron-finished trousers also ranked first for crease sharpness followed by the 50/50 cotton-polyester blend. Trousers of Categories A and D shared third position, while Trousers B again demonstrated the least desirable creases.

The Non-worn trousers revealed a slightly different pattern with reference to the appearance of the creases. The C Category still in first rank was followed by Trousers E in second position and Trousers A in third position. The creases of Types B and D both ranked fourth.

In overall comparisons of groups, without regard to trouser types, the Non-worn creases proved to be sharper than those in the worn groups. The trousers which were worn by the White Collar men had sharper creases than those of the Blue Collar group.

When evaluated on the men of the Blue Collar group during wear the panel rated the creases of the all-cotton Koratron-treated trousers as the sharpest, followed by the 50/50 cotton-polyester blend (Trousers E) in second position, and the 65/35 cotton-polyester (Trousers D) as third in rank. Fourth position was assigned to the all-cotton trousers of Category A, with Trousers B in last place with respect to crease sharpness.

The trousers of the White Collar group received the same rank position as those of the Blue Collar group with one exception. Trousers D and E performed in a comparable manner and, therefore, shared second position when viewed by a panel during wear. The ratings for the White Collar trousers revealed that the creases for this group were sharper than those of the Blue Collar group.

In the opinion of the Blue Collar participants Type C trousers exhibited the sharpest creases during wear. These men rated the performance of Trousers D and E as comparable for second rank and the trousers of the A and B Categories comparable for fourth rank.

In contrast, the men of the White Collar group evaluated the creases of their trousers of Categories C, D, and E equal in performance for first rank and the two remaining all-cotton trousers in fourth position.

When statistical comparisons were made of the crease ratings given the five trouser types by the participants of the Blue Collar group with those of the White Collar group there were no significant differences noted between the values assessed the groups at any of the three periods of data analysis.

Comparison of the cumulative crease data which were obtained by the three methods of evaluation mentioned above revealed the fact that ratings by AATCC Standards were comparable to the ratings by the panel on the men of the White Collar group. The men of the Blue Collar group rated the sharpness of the creases in their trousers higher than the panel rated them either by AATCC Standards or on the men. The creases had a slightly sharper appearance on the men of the Blue Collar group during wear than when evaluated in the laboratory before wear under AATCC Standards.

APPEARANCE OF SEAMS

According to AATCC Standards the smoothest seams for the Blue Collar group of trousers were observed by the panel in the two blends (Trousers D and E) which ranked first and second, respectively. The all-cotton Trousers C, B, and A followed in the order given for third, fourth, and fifth rankings for seam smoothness.

The White Collar and the Non-worn groups received scores which resulted in the same overall ranking for both groups. In both instances the 65/35 cotton-polyester blend demonstrated superior seam smoothness. The all-cotton Koratron-finished trousers shared second position with the 50/50 cotton-polyester trousers, while Trousers B placed fourth in rank followed by the A Trousers, which exhibited the most puckered seams.

A comparison of the performance between the groups showed higher overall seam smoothness scores for the Non-worn trousers; however, the seam smoothness of the trousers of the Blue Collar group out-performed that of the White Collar group.

When evaluated on the men of the Blue Collar group during wear, the panel found that the trousers of the D Category excelled all other trouser classifications with reference to seam smoothness. The seam smoothness performance of Trousers C and E was comparable and received second position in rank, while A and B ranked fourth.

In the White Collar group the two blends, Types D and E, ranked first and second. The all-cotton C, B, and A Trousers followed in the order mentioned.

Overall the Blue Collar group of trousers had smoother seams than those of the White Collar group. Perhaps

this could be explained by the possibility that as the Blue Collar trousers received more rigorous laundry treatment to remove heavy soil, the stabilizing finish was removed and, therefore, a greater amount of shrinking occurred which could have resulted in less pucker in the seam lines.

The men of the Blue Collar group rated their trousers of Categories D and C in first position with reference to seam smoothness. A, B, and E Trousers all were given comparable ratings which placed them in third rank.

Three trouser classifications (C, D, and E) were assessed equally in first rank by the men of the White Collar group. Comparable ratings for A and B placed them both in fourth rank.

In the overall assessment, the Blue Collar group rated the seam smoothness of their trousers of B and D Categories higher than the White Collar group rated their trousers of those respective groups.

In a comparison of the three methods of evaluation for the smoothness of seams, the AATCC evaluations for the trousers of the Blue Collar group and the evaluations of the participants were not as high as the panel's rating during wear. For the trousers of the White Collar group the AATCC evaluations were higher than either of the other

evaluations. The panel and the participants made comparable evaluations during wear.

EVALUATION OF APPARENT SOIL

The amount of soil which was on the trousers of the Blue Collar group was not significantly different at any stage of the study or between any of the respective trouser types when evaluations of soiling before laundering were assessed.

In the White Collar group Trousers D exhibited more soiling than did the remainder of the types. The scores indicated that all trousers accepted more soil with continued use. In all instances the trousers of the Blue Collar group showed a higher degree of soiling than the White Collar trousers.

Soil evaluations for the Blue Collar group after laundering showed that all of the soil failed to be removed from the trousers by the laundering formula which was used in the study. Trousers C rated higher than did Trousers D which was the only instance when one category showed superiority over the other categories with reference to their cleanliness ratings.

Trousers D also showed a higher degree of soiling in the evaluations after laundering for trousers of the

White Collar group.

Identical performance patterns were evidenced in the comparisons after laundering as were observed before laundering. In every instance the White Collar group had demonstrated less soil than did the Blue Collar group.

A final summary of the findings of this study is given in concise form in Summary C. These data represent the rank order of each trouser category for each respective type of evaluation which was used in the study to determine the appearance of the trousers. The ranks were totaled for each type of trousers and divided by the number of assessments in order to find the following mean overall ranks:

Rank	Type of Trousers
1	All-cotton (C)
2	65/35 Cotton-polyester (D)
3	50/50 Cotton-polyester (E)
4	All-cotton (A)
5	All-cotton (B)

SUMMARY C

OVERALL RANKINGS OF MEN'S DURABLE PRESS TROUSERS WITH RESPECT TO APPEARANCE

Trouser Type	Type of Evaluation											Overall Rank
	AATCC Standards			Panel During Wear			Rating by Men			Soiling		
	Fabric	Creases	Seams	Fabric	Creases	Seams	Fabric	Creases	Seams	Before Laundering	After Laundering	
Blue Collar												
A	4	2	5	4	4	4	3	4	3	1	2	4
B	5	5	4	5	5	4	3	4	3	1	2	5
C	1	1	3	3	1	2	1	1	1	1	1	1
D	1	2	1	1	3	1	1	2	1	1	2	1
E	3	2	2	1	2	2	3	2	3	1	2	3
White Collar												
A	4	3	5	4	4	5	4	4	4	1	1	4
B	5	5	4	5	5	4	4	4	4	1	1	5
C	1	1	2	3	1	3	1	1	1	1	1	1
D	1	3	1	1	2	1	1	1	1	5	5	3
E	3	2	2	1	2	2	1	1	1	1	1	2
Non-Worn												
A	4	3	5									4
B	5	4	4									5
C	1	1	2									1
D	2	4	2									2
E	2	2	2									2

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APPENDIX

TABLE I

SMOOTHNESS OF DURABLE PRESS TROUSERS WORN BY MEN OF THE BLUE COLLAR GROUP AS EVALUATED BY AATCC STANDARDS AFTER DESIGNATED PERIODS OF WEAR AND LAUNDERING

Trouser Types	Wear-Laundering Periods					
	1-5	6-10	11-15	16-20	21-25	26-30
A (100) 100% Cotton	3.7	3.8	3.9	4.0*	4.0*	3.8*
B (200) 100% Cotton	3.2	3.4	3.4	3.6*	3.6*	3.4*
C (300) 100% Cotton	4.6	4.6	4.7*	4.7*	4.7*	5.0*
D 65/35 Cotton-Polyester	4.5	4.4	4.6	4.6	4.8	4.7*
E 50/50 Cotton-Polyester	4.3	4.4	4.3	4.5	4.7	4.6*

*Refer to Summary B for number of pairs of trousers which remained in service at designated periods of wear.

TABLE II

SMOOTHNESS OF DURABLE PRESS TROUSERS WORN BY MEN OF THE WHITE COLLAR GROUP AS EVALUATED BY AATCC STANDARDS AFTER DESIGNATED PERIODS OF WEAR AND LAUNDERING

Trouser Types	Wear-Laundering Periods					
	1-5	6-10	11-15	16-20	21-25	26-30
A (100) 100% Cotton	3.7	3.9	4.0	4.1	4.2	4.1
B (200) 100% Cotton	3.2	3.5	3.5	3.7	3.7	3.5
C (300) 100% Cotton	4.7	4.8	4.9	4.9	5.0	4.9
D 65/35 Cotton-Polyester	4.7	4.8	4.9	4.9	4.9	4.9
E 50/50 Cotton-Polyester	4.7	4.7	4.8	4.8	4.9	4.8

TABLE III

SMOOTHNESS OF NON-WORN DURABLE PRESS TROUSERS AS EVALUATED BY AATCC STANDARDS AFTER DESIGNATED PERIODS OF LAUNDERING AND TUMBLE DRYING*

Trouser Types	Laundering Periods					
	1-5	6-10	11-15	16-20	21-25	26-30
A (100) 100% Cotton	4.0	4.3	4.2	4.4	4.4	4.4
B (200) 100% Cotton	3.3	3.6	3.7	3.9	3.9	3.9
C (300) 100% Cotton	4.8	4.9	5.0	5.0	4.9	4.9
D 65/35 Cotton Polyester	4.1	5.0	4.9	5.0	5.0	4.9
E 50/50 Cotton-Polyester	4.7	4.7	4.7	4.9	4.9	4.9

*Cooperative data also reported by Silalahi (49).

TABLE IV

SMOOTHNESS OF DURABLE PRESS TROUSERS AS EVALUATED ON MEN OF THE BLUE COLLAR GROUP AT DESIGNATED PERIODS OF WEAR

Trouser Types	Periods of Wear					
	5	10	15	20	25	30
A (100) 100% Cotton	3.6	3.4	3.1	3.1*	3.0*	2.8*
B (200) 100% Cotton	3.2	3.0	3.0	2.7*	2.8*	2.9*
C (300) 100% Cotton	3.9	3.2	3.3*	3.4*	4.0*	3.7*
D 65/35 Cotton-Polyester	4.2	3.8	3.6	3.5	3.6	3.6*
E 50/50 Cotton-Polyester	4.1	3.8	3.8	3.6	3.7	3.8*

*Refer to Summary B for number of pairs of trousers which remained in service at designated periods of wear.

TABLE V

SMOOTHNESS OF DURABLE PRESS TROUSERS AS EVALUATED ON MEN OF THE WHITE COLLAR GROUP AT DESIGNATED PERIODS OF WEAR

Trouser Types	Periods of Wear					
	5	10	15	20	25	30
A (100) 100% Cotton	3.5	3.6	3.3	3.4	3.1	3.4
B (200) 100% Cotton	3.3	3.3	3.4	3.1	2.8	3.2
C (300) 100% Cotton	3.9	3.8	3.7	3.7	3.8	3.6
D 65/35 Cotton-Polyester	4.2	4.0	4.1	4.0	4.1	4.0
E 50/50 Cotton-Polyester	4.2	4.2	4.1	4.0	3.9	3.8

TABLE VI

SMOOTHNESS OF DURABLE PRESS TROUSERS AS EVALUATED BY MEN OF THE BLUE COLLAR GROUP AT DESIGNATED PERIODS OF WEAR

Trouser Types	Periods of Wear				
	10	15	20	25	30
A (100) 100% Cotton	4.0	3.5	3.5*	3.4*	3.4*
B (200) 100% Cotton	4.0	3.5	3.4*	3.5*	3.5*
C (300) 100% Cotton	4.0	3.8*	3.9*	4.0*	4.0*
D 65/35 Cotton-Polyester	4.1	4.0	3.7	3.6	4.0
E 50/50 Cotton-Polyester	3.9	3.8	3.9	3.6	3.6*

*Refer to Summary B for number of pairs of trousers which remained in service at designated periods of wear.

TABLE VII

SMOOTHNESS OF DURABLE PRESS TROUSERS AS EVALUATED BY MEN OF THE WHITE COLLAR GROUP AT DESIGNATED PERIODS OF WEAR

Trouser Types	Periods of Wear				
	10	15	20	25	30
A (100) 100% Cotton	3.6	3.5	3.4	3.1	3.2
B (200) 100% Cotton	3.5	3.6	3.4	3.3	3.2
C (300) 100% Cotton	3.9	3.7	3.7	3.7	3.7
D 65/35 Cotton-Polyester	4.1	3.7	4.0	3.7	3.9
E 50/50 Cotton-Polyester	4.2	4.0	4.1	4.0	3.6

TABLE VIII

APPEARANCE OF CREASES OF DURABLE PRESS TROUSERS WORN BY MEN OF THE BLUE COLLAR GROUP AS EVALUATED BY AATCC STANDARDS AFTER DESIGNATED PERIODS OF WEAR AND LAUNDERING

Trouser Types	Wear-Laundering Periods					
	1-5	6-10	11-15	16-20	21-25	26-30
A (100) 100% Cotton	3.2	3.0	2.9	2.9*	2.6*	2.3*
B (200) 100% Cotton	3.1	2.7	2.7	2.5*	2.0*	1.8*
C (300) 100% Cotton	4.4	4.3	4.4*	4.2*	4.2*	4.5*
D 65/35 Cotton-Polyester	2.7	2.7	2.8	2.8	2.7	2.6*
E 50/50 Cotton-Polyester	3.0	2.7	2.9	2.9	2.8	2.7*

*Refer to Summary B for number of pairs of trousers which remained in service at designated periods of wear.

TABLE IX

APPEARANCE OF CREASES OF DURABLE PRESS TROUSERS WORN BY MEN OF THE WHITE COLLAR GROUP AS EVALUATED BY AATCC STANDARDS AFTER DESIGNATED PERIODS OF WEAR AND LAUNDERING

Trouser Types	Wear-Laundering Periods					
	1-5	6-10	11-15	16-20	21-25	26-30
A (100) 100% Cotton	3.3	3.1	3.0	3.0	2.7	2.8
B (200) 100% Cotton	3.1	3.0	2.8	2.7	2.5	2.2
C (300) 100% Cotton	4.6	4.6	4.6	4.6	4.4	4.2
D 65/35 Cotton-Polyester	3.1	3.1	3.0	3.0	2.9	2.8
E 50/50 Cotton-Polyester	3.4	3.4	3.1	3.1	3.2	3.0

TABLE X

APPEARANCE OF CREASES OF NON-WORN DURABLE PRESS TROUSERS AS EVALUATED BY AATCC STANDARDS AFTER DESIGNATED PERIODS OF LAUNDERING AND TUMBLE DRYING*

Trouser Types	Laundering Periods					
	1-5	6-10	11-15	16-20	21-25	26-30
A (100) 100% Cotton	3.5	3.4	3.1	3.3	3.1	3.0
B (200) 100% Cotton	3.4	3.1	3.0	3.2	3.0	3.0
C (300) 100% Cotton	4.6	4.6	4.7	4.7	4.3	4.5
D 65/35 Cotton-Polyester	3.1	3.2	2.9	2.9	2.9	2.9
E 50/50 Cotton-Polyester	3.7	3.6	3.4	3.5	3.2	3.1

*Cooperative data also reported by Silalahi (49).

TABLE XI

APPEARANCE OF CREASES OF DURABLE PRESS TROUSERS AS EVALUATED ON MEN OF THE BLUE COLLAR GROUP AT DESIGNATED PERIODS OF WEAR

Trouser Types	Periods of Wear					
	5	10	15	20	25	30
A (100) 100% Cotton	3.5	3.1	2.8*	2.7*	2.5*	2.2*
B (200) 100% Cotton	3.5	2.7	2.5*	2.4*	2.2*	2.2*
C (300) 100% Cotton	4.4	4.1	3.7*	3.6*	4.0*	4.3*
D 65/35 Cotton-Polyester	3.7	3.5	3.2	2.9	2.9	3.0*
E 50/50 Cotton-Polyester	3.9	3.4	3.5	3.3	3.2	3.1*

*Refer to Summary B for number of pairs of trousers which remained in service at designated periods of wear.

TABLE XII

APPEARANCE OF CREASES OF DURABLE PRESS TROUSERS AS EVALUATED ON MEN OF THE WHITE COLLAR GROUP AT DESIGNATED PERIODS OF WEAR

Trouser Types	Periods of Wear					
	5	10	15	20	25	30
A (100) 100% Cotton	3.0	3.3	2.9	2.7	2.7	2.5
B (200) 100% Cotton	2.8	2.9	2.7	2.7	2.4	2.4
C (300) 100% Cotton	3.9	4.0	3.7	3.8	3.8	3.7
D 65/35 Cotton-Polyester	3.4	3.8	3.7	3.5	3.4	3.3
E 50/50 Cotton-Polyester	3.7	4.0	3.6	3.5	3.4	3.3

TABLE XIII

APPEARANCE OF CREASES OF DURABLE PRESS TROUSERS AS EVALUATED BY MEN OF THE BLUE COLLAR GROUP AT DESIGNATED PERIODS OF WEAR

Trouser Types	Periods of Wear				
	10	15	20	25	30
A (100) 100% Cotton	3.7	3.3	3.1*	2.9*	3.2*
B (200) 100% Cotton	3.6	3.2	3.1*	3.0*	3.0*
C (300) 100% Cotton	4.1	3.8*	3.8*	4.0*	4.0*
D 65/35 Cotton-Polyester	3.7	3.7	3.3	3.3	3.6
E 50/50 Cotton-Polyester	3.6	3.5	3.5	3.5	3.4

*Refer to Summary B for number of pairs of trousers which remained in service at designated periods of wear.

TABLE XIV

APPEARANCE OF CREASES OF DURABLE PRESS TROUSERS AS EVALUATED BY MEN OF THE WHITE COLLAR GROUP AT DESIGNATED PERIODS OF WEAR

Trouser Types	Periods of Wear				
	10	15	20	25	30
A (100) 100% Cotton	3.4	3.3	3.1	3.2	2.9
B (200) 100% Cotton	3.3	3.3	3.4	2.9	2.8
C (300) 100% Cotton	3.9	3.8	3.9	3.9	3.5
D 65/35 Cotton-Polyester	4.1	3.3	3.7	3.5	3.8
E 50/50 Cotton-Polyester	3.8	4.0	3.8	3.5	3.4

TABLE XV

APPEARANCE OF SEAMS OF DURABLE PRESS TROUSERS WORN BY MEN OF THE BLUE COLLAR GROUP AS EVALUATED BY AATCC STANDARDS AFTER DESIGNATED PERIODS OF WEAR AND LAUNDERING

Trouser Types	Wear-Laundering Periods					
	1-5	6-10	11-15	16-20	21-25	26-30
A (100) 100% Cotton	3.6	3.7	3.6	3.4*	3.4*	3.4*
B (200) 100% Cotton	3.7	3.9	3.7	3.6*	3.5*	3.5*
C (300) 100% Cotton	4.2	4.2	4.1*	3.9*	3.7*	4.0*
D 65/35 Cotton-Polyester	4.5	4.5	4.4	4.6	4.6	4.7*
E 50/50 Cotton-Polyester	4.4	4.4	4.2	4.2	4.3	4.3*

*Refer to Summary B for number of pairs of trousers which remained in service at designated periods of wear.

TABLE XVI

APPEARANCE OF SEAMS OF DURABLE PRESS TROUSERS WORN BY MEN OF THE WHITE COLLAR GROUP AS EVALUATED BY AATCC STANDARDS AFTER DESIGNATED PERIODS OF WEAR AND LAUNDERING

Trouser Types	Wear-Laundering Periods					
	1-5	6-10	11-15	16-20	21-25	26-30
A (100) 100% Cotton	3.6	3.6	3.4	3.2	3.3	3.2
B (200) 100% Cotton	3.7	3.6	3.6	3.6	3.5	3.5
C (300) 100% Cotton	4.3	4.2	4.1	4.0	4.1	4.1
D 65/35 Cotton-Polyester	4.6	4.6	4.6	4.7	4.8	4.8
E 50/50 Cotton-Polyester	4.2	4.1	4.0	4.1	4.1	4.1

TABLE XVII

APPEARANCE OF SEAMS OF NON-WORN DURABLE PRESS TROUSERS AS EVALUATED BY AATCC STANDARDS AFTER DESIGNATED PERIODS OF LAUNDERING AND TUMBLE DRYING*

Trouser Types	Laundering Periods					
	1-5	6-10	11-15	16-20	21-25	26-30
A (100) 100% Cotton	3.9	4.0	3.7	3.5	3.4	3.5
B (200) 100% Cotton	3.6	4.2	3.8	3.7	3.6	3.5
C (300) 100% Cotton	4.3	4.5	4.3	4.2	4.1	4.2
D 65/35 Cotton-Polyester	4.2	4.8	4.7	4.7	4.7	4.6
E 50/50 Cotton-Polyester	4.3	4.2	4.1	4.2	4.1	4.2

*Cooperative data also reported by Silalahi (49).

TABLE XVIII

APPEARANCE OF SEAMS OF DURABLE PRESS TROUSERS AS EVALUATED ON MEN OF THE BLUE COLLAR GROUP AT DESIGNATED PERIODS OF WEAR

Trouser Types	Periods of Wear					
	5	10	15	20	25	30
A (100) 100% Cotton	3.8	3.8	3.8	3.8*	3.7*	4.0*
B (200) 100% Cotton	3.8	3.7	3.9	3.9*	3.7*	3.7*
C (300) 100% Cotton	4.3	4.3	4.2*	4.0*	4.0*	4.7*
D 65/35 Cotton-Polyester	4.6	4.5	4.5	4.6	4.9	4.6*
E 50/50 Cotton-Polyester	4.1	4.0	4.2	4.1	4.5	4.6*

*Refer to Summary B for number of pairs of trousers which remained in service at designated periods of wear.

TABLE XIX

APPEARANCE OF SEAMS OF DURABLE PRESS TROUSERS AS EVALUATED ON MEN OF THE WHITE COLLAR GROUP AT DESIGNATED PERIODS OF WEAR

Trouser Types	Periods of Wear					
	5	10	15	20	25	30
A (100) 100% Cotton	3.3	3.2	3.2	3.3	3.4	3.1
B (200) 100% Cotton	3.5	3.8	3.4	3.4	3.5	3.3
C (300) 100% Cotton	3.9	3.9	3.9	3.8	3.7	3.8
D 65/35 Cotton-Polyester	4.3	4.2	4.1	4.3	4.5	4.5
E 50/50 Cotton-Polyester	3.8	3.8	4.0	3.9	4.1	4.2

TABLE XX

APPEARANCE OF SEAMS OF DURABLE PRESS TROUSERS AS EVALUATED BY MEN OF THE BLUE COLLAR GROUP AT DESIGNATED PERIODS OF WEAR

Trouser Types	Periods of Wear				
	10	15	20	25	30
A (100) 100% Cotton	4.3	3.5	3.4*	3.4*	3.4*
B (200) 100% Cotton	4.0	3.7	3.8*	3.5*	3.6*
C (300) 100% Cotton	4.2	4.0*	4.0*	4.0*	4.0*
D 65/35 Cotton-Polyester	4.3	4.2	3.7	4.2	4.1*
E 50/50 Cotton-Polyester	3.8	3.8	3.9	3.7	3.6*

*Refer to Summary B for number of pairs of trousers which remained in service at designated periods of wear.

TABLE XXI

APPEARANCE OF SEAMS OF DURABLE PRESS TROUSERS AS EVALUATED BY MEN OF THE WHITE COLLAR GROUP AT DESIGNATED PERIODS OF WEAR

Trouser Types	Periods of Wear				
	10	15	20	25	30
A (100) 100% Cotton	3.9	3.5	3.4	3.5	3.1
B (200) 100% Cotton	3.8	3.7	3.7	3.3	3.0
C (300) 100% Cotton	4.2	3.6	4.0	3.9	3.8
D 65/35 Cotton-Polyester	3.9	4.0	3.9	3.7	3.7
E 50/50 Cotton-Polyester	3.8	4.0	4.1	3.9	3.8

TABLE XXII

APPARENT SOIL ON DURABLE PRESS TROUSERS WORN BY MEN OF THE BLUE COLLAR GROUP AS EVALUATED BEFORE LAUNDERING

Trouser Types	Periods of Wear					
	1-5	6-10	11-15	16-20	21-25	26-30
A (100) 100% Cotton	3.0	2.5	2.1	2.0	2.3	2.3
B (200) 100% Cotton	3.0	2.3	2.0	2.0	2.4	2.8
C (300) 100% Cotton	3.0	3.0	2.1	2.3	2.4	2.3
D 65/35 Cotton-Polyester	2.9	2.5	2.0	2.2	2.3	2.4
E 50/50 Cotton-Polyester	3.0	2.3	2.0	2.1	2.9	2.4

TABLE XXIII

APPARENT SOIL ON DURABLE PRESS TROUSERS WORN BY MEN OF THE WHITE COLLAR GROUP AS EVALUATED BEFORE LAUNDERING

Trouser Types	Periods of Wear					
	1-5	6-10	11-15	16-20	21-25	26-30
A (100) 100% Cotton	3.9	3.9	3.7	3.6	3.7	3.5
B (200) 100% Cotton	3.9	3.8	3.7	3.8	3.6	3.6
C (300) 100% Cotton	4.0	3.8	3.7	3.8	3.7	3.3
D 65/35 Cotton-Polyester	3.8	3.6	3.6	3.5	3.3	3.2
E 50/50 Cotton-Polyester	4.0	3.7	3.6	3.7	3.6	3.6

TABLE XXIV

APPARENT SOIL ON DURABLE PRESS TROUSERS WORN BY MEN OF THE BLUE COLLAR GROUP AS EVALUATED AFTER LAUNDERING

Trouser Types	Periods of Wear					
	1-5	6-10	11-15	16-20	21-25	26-30
A (100) 100% Cotton	3.9	3.7	3.2	3.3	3.2	3.2
B (200) 100% Cotton	4.0	3.8	3.2	3.2	3.1	3.5
C (300) 100% Cotton	3.8	3.7	3.5	3.6	3.4	3.8
D 65/35 Cotton-Polyester	3.8	3.6	3.2	3.1	3.2	3.0
E 50/50 Cotton-Polyester	3.9	3.5	3.4	3.3	3.2	3.2

TABLE XXV

APPARENT SOIL ON DURABLE PRESS TROUSERS WORN BY MEN OF THE WHITE COLLAR GROUP AS EVALUATED AFTER LAUNDERING

Trouser Types	Periods of Wear					
	1-5	6-10	11-15	16-20	21-25	26-30
A (100) 100% Cotton	4.7	4.5	4.3	4.1	4.0	3.9
B (200) 100% Cotton	4.6	4.4	4.3	4.3	4.1	4.0
C (300) 100% Cotton	4.5	4.3	4.2	4.2	4.2	3.8
D 65/35 Cotton-Polyester	4.3	4.1	4.0	4.1	4.3	3.6
E 50/50 Cotton-Polyester	4.5	4.3	4.3	4.4	4.1	4.0