TRC

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**ANALYSIS OF ENDS DOWN AT ROTOR SPINNING** For as long as industry has been producing yarns on machines where multiple strands are formed simultaneously, we have been concerned with broken strands (ends down) that lead to a production rate less than 100%. Not only are broken ends viewed as a problem, but the cause of these has also been a major concern. The reasoning is that if the cause of the breaks can be determined, then possibly they can be eliminated.

A program conducted at the Textile Research Center made a detailed study of the causes of broken ends at open-end spinning. While spinning an $N_e$ 40 yarn from two carded and three combed slivers, an attempt was made to determine the exact cause of each spinning interruption through inspection of the broken yarns. A close examination of the yarn tail attached to the package was made in every case prior to repiecing. Though this was a time-consuming chore, it was carefully carried out by TRC's O-E spinning technicians.

Seven categories of causes were established. These are:

1. Seed coat - a small brown or black fragment of a cotton seed to which a fibrous fuzz is attached.
2. Bark - a thin wood-like strip of material apparently coming from the cotton stalk or stems.
3. Trash - brown or black organic material, pepper-like in appearance and non-fibrous in nature, originating from a leaf or other part of the cotton plant.
4. Nep - an apparently fibrous entanglement, a bundle whose length and width are relatively small and approximately equal.
5. Slub - a fibrous clump, generally several times greater in length than in width.
6. Mechanical - an interruption to the spinning process from causes other than the material being spun. In particular, inadvertent sensing of the absence of yarn in the winding zone by the detector wire when winding under conditions of low tension.
7. Unknown - interruptions for which no cause could be identified.

The material used in this study was processed through TRC's standard opening line and high-speed, revolving flat cards. It was then drawn according to its ultimate use in a carded or combed yarn. For producing carded yarn, two and three processes of drawing were used. For the stock that was to be combed, one process of drawing and a superlapper were employed prior to combing, followed by two more drawings before spinning. In every case, the sliver fed to the Schlafhorst Autocoro spinning machine was 40 gr/yard. A tabulation of cotton fiber data, spinning specifications, and yarn testing results are given on the following page.

A summary of the analysis of the breaks is given on page 3. A study of this reveals some rather interesting points. One of these is that seed coat fragments were a major cause of ends down, in both the carded categories, and when only 8% noils were removed, seed coat particles were the primary cause. This situation was helped considerably by increasing noil extraction to 15% and 22%, although even then seed coat fragments were responsible for more than one-fifth of all broken strands of yarn. While bark is purported to be a major detriment to spinning, it did not appear to cause nearly as high a percentage of ends down as did seed coat fragments, other types of trash, or slubs.

We are presenting two graphs that show interesting data resulting from this study. The first of these shows the relationship between the upper quartile length (in inches) and the noils extracted. The second is related to this and compares short fiber content with noil removal. Both measurements were made using the sliver after its final preparation. As might be expected, the upper quartile length increases as the short fibers are removed, and the short fiber content reacts in exactly the opposite manner.

Graph I
Rotor Spinning Results

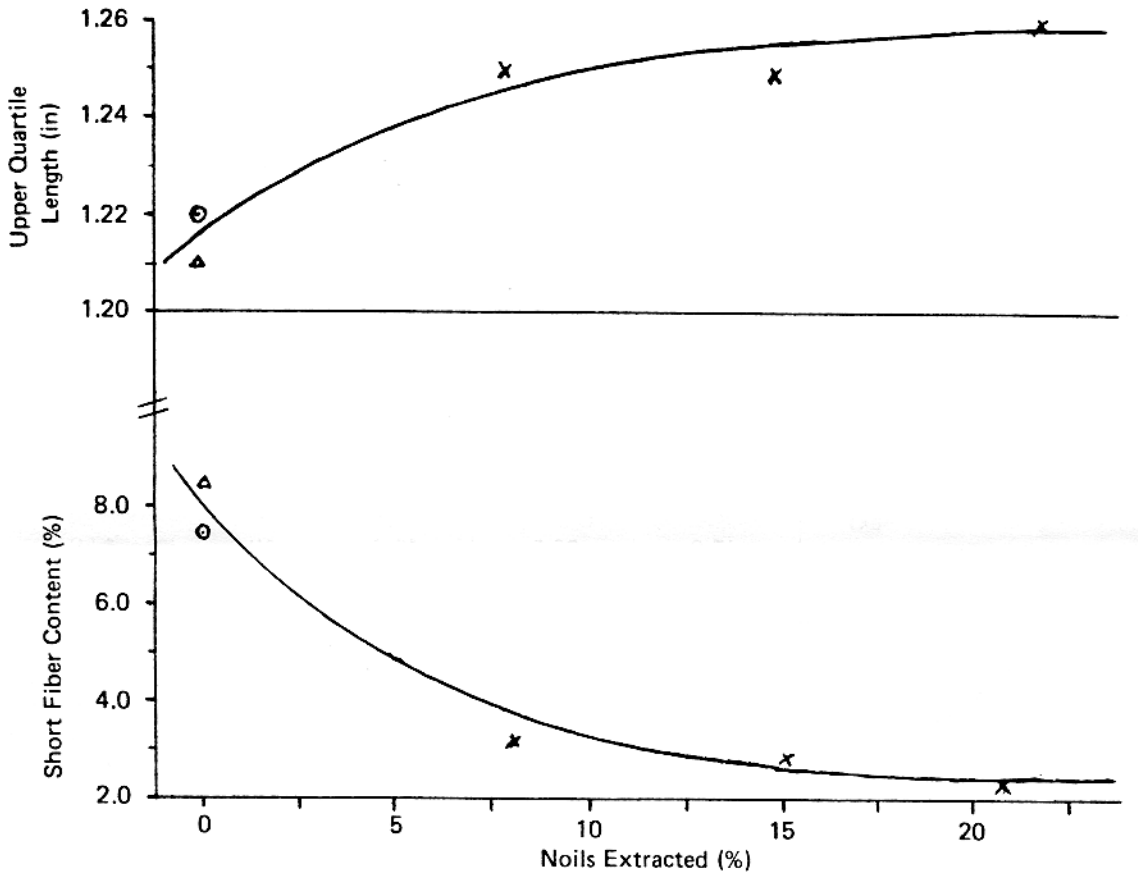
| | | | | | |
|---|---|---|---|---|---|
| **FIBER DATA (Chute Feed Sample)** | | | | | |
| Micronaire | 3.66 | | | | |
| 2.5% Span Length (in) | 1.145 | | | | |
| Uniformity (%) | 44.1 | | | | |
| Short Fibers (%) | 3.88 | | | | |
| Stelometer Strength (g/tex) | 29.86 | | | | |
| Elongation (%) | 6.00 | | | | |
| Shirley Non-Lint Content (%) | 2.86 | | | | |
| **SLIVER** | Carded | | Combed | | |
| **SPINNING SPECIFICATION** | | | | | |
| Machine | Schlafhorst Autocoro | | | | |
| Nominal Yarn No. ($N_e$) | 40 | | | | |
| Rotor Type | G40 | | | | |
| Rotor Speed (rpm) | 72,000 | | | | |
| Opening Roller Type | OB20 | | | | |
| Opening Roller Speed (rpm) | 7000 | | | | |
| Draft | 189.4 | 187.6 | 191.4 | 189.4 | 187.6 |
| Twist Multiplier | 4.47 | | | | |
| Yarn Speed (yd/min) | 70.7 | | | | |
| Navel | KK4 | | | | |
| Ambient Conditions | 72°F/56% RH | | | | |
| Drawframe Passes | 2 | 3 | 2 | | |
| Noils Extracted (%) | 0 | 0 | 8 | 15 | 22 |
| Test Duration (Rotor Hours) | 102 | | | | |
| **YARN PROPERTIES** | | | | | |
| Skein Test | | | | | |
| Actual Yarn Number ($N_e$) | 40 59 | 40.12 | 40.83 | 40.59 | 40.57 |
| CV% of Count | 1.6 | 1.2 | 1.0 | 3.5 | 2.2 |
| Count-strength-product | 1756 | 1759 | 1852 | 1902 | 1931 |
| CV% of CSP | 3.0 | 4.0 | 2.5 | 2.5 | 2.9 |
| Single Yarn Tensile Test | | | | | |
| Tenacity (g/tex) | 11.94 | 12.06 | 13.37 | 13.58 | 13.29 |
| Mean Strength (g) | 174 | 178 | 193 | 198 | 193 |
| CV% of Strength | 10.2 | 12.1 | 9.3 | 9.7 | 10.8 |
| Elongation (%) | 4.99 | 4.87 | 4.91 | 4.57 | 4.88 |
| CV% of Elongation | 9.9 | 11.2 | 10.8 | 10.9 | 9.8 |
| Specific Work of Rupture (g/tex) | 0.317 | 0.314 | 0.344 | 0.355 | 0.342 |
| CV% of Work of Rupture | 17.6 | 20.9 | 18.4 | 18.2 | 17.8 |
| Uster Evenness Test | | | | | |
| Non Uniformity (CV%) | 18.55 | 19.68 | 20.10 | 19.87 | 19.71 |
| Thin Places/1 000 yds | 294 | 457 | 534 | 531 | 498 |
| Thick Places/1,000 yds | 467 | 718 | 815 | 794 | 722 |
| Neps/1 000 yds | 1499 | 2149 | 2285 | 2092 | 1852 |
| Hairs/100 yds | 300 | 335 | 357 | 368 | 333 |
| Performance | | | | | |
| Number of Breaks* | 62 | 60 | 29 | 25 | 18 |
| Break Rate/1000 R. hrs | 610 | 588 | 285 | 246 | 177 |

*Non-mechanical

In view of inquiries we have received from a number of textile companies concerning rotor spinning of cottons from various parts of the United States, we feel this information will be interesting and perhaps useful. This study was conducted at the Textile Research Center by John B. Price, head of our New Spinning Technologies Research, with assistance from William D. Cole and Albert Esquibel.

Graph II
Analysis of Breaks
Number per 100 Rotor Hours and (Percentage)

| Cause | Carded | | | | Combed | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| | 2 Processes of Drawing | | 3 Processes of Drawing | | Noil Removal | | | | | |
| | | | | | 8% | | 15% | | 22% | |
| – Seed coat | 44 | (57.1) | 37 | (50.7) | 11 | (30.6) | 8 | (23.5) | 6 | (22.2) |
| – Bark | 3 | (3.9) | 2 | (2.7) | 4 | (11.1) | 3 | (8.8) | 1 | (3.7) |
| – Trash | 7 | (9.1) | 11 | (15.1) | 6 | (16.7) | 3 | (8.8) | 3 | (11.1) |
| – Neps | 1 | (1.3) | 0 | (0) | 1 | (2.8) | 0 | (0) | 1 | (3.7) |
| – Slubs | 7 | (9.1) | 10 | (13.7) | 7 | (19.4) | 11 | (32.3) | 7 | (25.9) |
| – Mechanical | 1 | (1.3) | 0 | (0) | 1 | (2.8) | 9 | (26.4) | 0 | (0) |
| – Unknown | 14 | (18.2) | 13 | (17.8) | 6 | (16.7) | 0 | (0) | 9 | (33.3) |
| Total (overall) | 77 | (100) | 73 | (100) | 36 | (100) | 34 | (100) | 27 | (99.9) |
| (identified textile) | 62 | | 60 | | 29 | | 25 | | 18 | |



**VISITORS** Visitors to the Textile Research Center during February included Jack Keasler, Stewarts of America, Inc., Simpsonville, SC; Allen Francario, Allied Fibers, Petersburg, VA; Lindley Jones, Allied Fibers, Columbia, SC; Wayland W. McAllister, Alpha Cellulose Corporation, Lumberton, NC; Maxie Powell, Henkel Corporation, Charlotte, NC; Randy Youngblood, Ruse Rouge, Dallas, TX; Kim McAleer and Ronnie Kennett, Oneita Industries, Andrews, SC; Ross Wilson, Texas Cattle Feeders Association, Amarillo, TX; and Harvey Campbell, Jr., Campbell, West & Associates, Bakersfield, CA.

Sixteen engineering students visiting Texas Tech University from various universities in Lower Saxony, Germany also toured the Center, as did ninety students from Texas Tech's Department of Merchandising, Environmental Design and Consumer Economics.