Cotton

- **Cotton** is a staple fiber; its characteristics depend on seed variety, growing conditions, and processing.

- Cotton is grown in tropical and sub-tropical regions; almost two-thirds of the world’s cotton is grown in China, India, and the U.S. Two main varieties grown in the U.S. are **Upland and Pima**; Upland accounts for approximately 95% of the production.

- Cotton is **graded** based on:
  - Length (longer is better)
  - Color (whiter is better, except in naturally colored cottons)
  - Cleanliness (brown flecks of “trash” are undesirable)
  - Fineness (finer is better)
  - Strength (stronger is better)
Upland Cotton with Varying Levels of Trash Content

Note: Trash content is one of the factors used for grading cotton.
Fiber Length

The fiber length of cotton varies by variety.

- American **Upland** cotton ranges from \(7/8\) to \(1\ 5/16\) inches, and American **Pima** cotton from \(1\ 1/4\) to \(1\ 9/16\) inches.
  
  Note: Supima® is a registered trademark for pima cotton that meets brand criteria.

- **Pima** and **Egyptian** are examples of **extra long staple** fibers. As these are better quality cotton varieties, they are included on the fiber content or tags.
  
  Note: Not all cotton grown in Egypt is Egyptian cotton variety.
Fiber Color

- Cotton is typically off-white with the exception of naturally colored cotton.
  - **Off-white** cotton requires bleaching before it is dyed.
  - **Colored** cotton, available in limited quantities, does not require bleaching or dyeing; therefore, it is considered eco-friendly.
Surface Contour and Shape

- **Surface Contour (longitudinal view)** – Has a natural twist and looks like a ribbon when viewed under a microscope.

- **Shape (cross-section)** – Kidney-shaped with a hollow center core known as a lumen. The cross-section of mercerized cotton is more circular as the fiber swells when treated with alkali.

Courtesy Intertek Testing Services
Performance Highlights

- **Most commonly used natural fiber**
  - Long staple varieties used for higher quality fabrics.

- **Medium strength**; longer staples are relatively stronger than shorter staples.
  - Heavier-weight cotton fabrics have sufficient strength for rugged wear.

- **Poor flexing abrasion resistance**
  - Fabrics show wear at edges (e.g., shirt cuffs/collars) or areas where the fabric rubs against another surface.

- **Poor wrinkle resistance**
  - To improve wrinkle resistance, cotton is blended with other fibers, or has a finish applied.
Performance Highlights

- **Hydrophilic, good moisture absorption**
  - No static buildup in dry weather.
  - Comfortable in hot climates.
  - Slow to dry; may feel clammy when wet.

- **Does not irritate the skin**

- **Biodegradable**
  - Cotton used outdoors over time degrades and is susceptible to rot. A functional finish is usually applied to prevent degradation.

- **Damaged by prolonged exposure to sunlight**
  - Yellows and degrades with extended exposure to sunlight; draperies made of cotton should be lined.

- **Burns** quickly like paper
End Uses

- **Apparel**
  - Used extensively for casualwear, sleepwear, undergarments, socks, and accessories.
  - Cotton and cotton/poly blends hold major market share for jeans, T-shirts, men's dress shirts, casual shirts, pants, and undergarments.
  - Cotton and its blends are used for sweaters, children's clothing, and work clothing.

- **Textiles for Interiors**
  - Used for draperies, upholstery and bedspreads. May be treated with stain repellent finishes and glazed to improve luster.
  - Used for area rugs and mats, but rarely used as carpeting due to low crush resistance.
    - Tufted cotton rugs for bath and door mats are easily flattened.
**End Uses**

- **Household & Institutional Textiles**
  - Holds major market share for towels due to its absorbency.
  - The majority of bed linens are cotton and cotton/polyester blends.
  - Cotton and cotton blends are used for comforters, table linens, and shower curtains.
  - Used for other household and institutional items such as dish cloths and mops.

- **Technical Textiles**
  - Used for cotton balls, gauze bandages, and other personal hygiene products.
  - Cotton and cotton blends treated with functional finishes are used for protective workwear garments.
    E.g., cotton and cotton/nylon blends with flame retardant finish are used for flame resistant (FR) workwear garments.
Care

- **Easy to clean** with most laundry detergents; not damaged by alkalis.

- Stronger when wet, so cotton fabrics **withstand agitation** during washing and drying.

- May shrink during the first few washes due to **relaxation shrinkage**.

- **Can be bleached** with chlorine bleach but excessive use will weaken fibers (do not pour directly onto fabric).

- Not damaged by organic solvents; **dry cleanable**.

- **Iron at a high temperature** (cotton setting).
  - Fabrics with a **durable press finish** are ironed at a lower setting.
  - Fabrics with finishes (e.g. embossing) may require lower temperatures.

- Susceptible to **mildew** and **silverfish**.
Mildew on a Cotton Canvas Bag

Magnified view
Eco-Friendly Cotton

- Attempts to minimize use of pesticides, fertilizers or other auxiliary chemicals.

- Only cotton meeting the criteria set for organic products can be labeled **organic**. Several national and international organizations, such as **GOTS (Global Organic Textile Standard)**, certify organic cotton using internationally recognized standards.

- **Naturally colored cotton** eliminates the need for dyeing and is considered environmentally friendly, though its fiber quality is generally lower than similar white cotton fibers. Many colored cottons are organically grown.

- The term **green cotton has not been defined** by standards setting organizations and is subject to interpretation.
An Example of Certified Organic Cotton Label

This towel set is made with Certified 100% ORGANIC COTTON... the way Mother Nature intended!

Certified
100% ORGANIC COTTON

BATH TOWELS

Fields certified by: ECO-CERT
Processing certified by: Skal INTERNATIONAL

ECOCERT
Skal INTERNATIONAL
Fabric Manufactured with "Green Cotton"

Note: The term green cotton is not currently defined by a standards setting organization; therefore, it is subject to interpretation. Labeling of this fabric as green cotton implies that it was processed without use of harsh chemicals such as bleaches, harsh detergents, certain dyes and additives used in textile processing. However, there is no way to verify the information.
Flax (Linen)

- Flax is one of the world’s oldest textile fibers. The fibers are obtained from the stem of the flax plant.

- France, Belgium, and Ireland are historically known for fine linens. Linen is now being imported from Russia and China.

- After harvesting, flax stems are exposed to microorganisms or chemical rotting agents (retting) to prepare the fibrous material for separation. The retting process affects the color and quality.

- The long, finer quality fibers are called line and the short fibers are called tow. Note: A subtle luster due to residual waxes from the flax stem is typically seen in line flax fibers.

- Fabrics made of flax fibers are known as linen. Linen produced from line fibers is relatively expensive and is limited in quantity.
Flax

flax stalks with seed pods

inner non-fibrous layer

outer fibrous layer

a flax stalk broken and the two pieces pulled apart to show the outer layer of the stalk with fibers
Surface Contour and Shape

- **Surface Contour (longitudinal view)** - Straight with nodes that look like bamboo. Fibers are often bundled, giving linen fabrics a characteristic uneven texture. The "linen look" is imitated with other fibers.

- **Shape (cross-section)**
  - Polygonal with rounded edges and a small lumen (not visible in all fibers). Shape and diameter vary considerably.
Linen and “Linen Look” Fabrics Made with Other Fibers

Magnified images of 1 cm squares
Performance Highlights

- **Very strong**; withstands regular wear; retains its strength over time.

- **High flat abrasion resistance** due to high strength; **poor flex and edge abrasion resistance** due to high stiffness.

- **Very poor wrinkle resistance**; wrinkles are difficult to remove.

- **Does not irritate the skin.**

- **Hydrophilic; very good moisture absorption** and **wicking.**
  - Comfortable in warm weather
  - No static buildup in dry weather

- **Biodegradable**

- **Damaged by** prolonged exposure to **sunlight**; more resistant to light than cotton.
Poor Wrinkle Recovery - Linen shirt after being crushed by hand for approximately 30 seconds.
End Uses

- **Apparel**
  - Men's and women's apparel.
  - Lightweight linen, commonly known as handkerchief linen, is used for apparel and high quality handkerchiefs.

- **Textiles for Interiors**
  - Draperies, upholstery, wall coverings.

- **Household & Institutional Textiles**
  - High quality table cloths, napkins, and bed linens.
  - Lint-free glass cloth, dish towels (tea towels), hand towels.
Drapery Made with Linen Fabric With Metallic Print
Care

- **Cleaned with standard laundry detergents**; not damaged by alkalis.

- **Can be bleached** with chlorine bleach but excessive use will weaken fibers (do not pour directly onto fabric).

- Not damaged by organic solvents; **dry cleanable**.

- **Iron at a high temperature** (linen setting) with steam setting.
  - Fabrics treated with a **durable press finish** are ironed at a lower setting.

- Susceptible to mildew and silverfish.