

Cotton & Circularity: The Natural Loop

Cotton begins its life as a natural fiber, grown from soil, sunlight, and water, sequestering carbon as it grows. This inherent connection to the earth makes it a perfect fit for a circular economy—a system designed to eliminate waste by enabling products to be reused, recycled, and ultimately, returned to the soil in a continuous loop.

True circularity begins at the source. Every part of the cotton plant has a purpose, ensuring nothing is wasted—all without requiring extra land, water, fertilizer, or other support.¹

Cotton Fiber: The cotton lint is spun into the familiar, versatile fiber used for textiles.

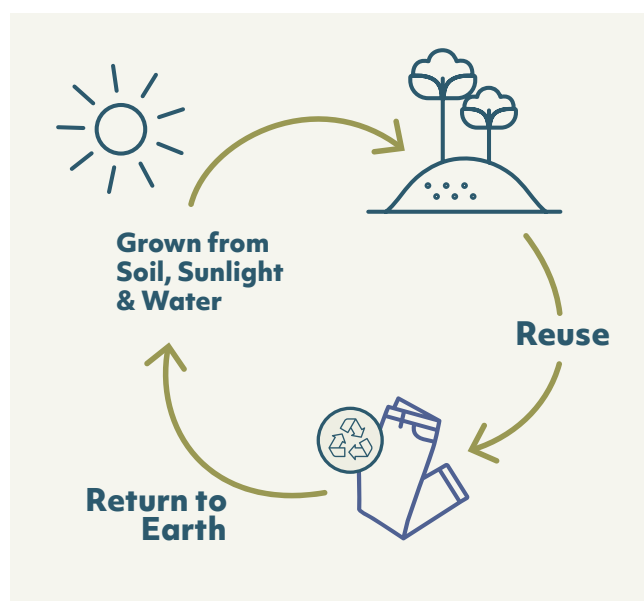
Cottonseeds: The seeds are pressed to create highly stable [cottonseed oil](#),² used in applications from cooking to cosmetics and even biodiesel.³

Co-products: The remaining [whole cottonseed](#) serves as a protein-rich feed for cattle, with research showing it enhances both milk yield and fat content.⁴ Approximately more than 50% of the annual U.S. whole cottonseed supply is fed to dairy cattle.⁵ Stems and stalks can be tilled back into the ground to enrich the soil or used for bioenergy.¹

Closing the Loop: Reuse and Recycling

High-quality cotton garments are durable, supporting long lifespans and a thriving secondhand market that reduces the need for virgin materials. When a cotton product reaches the end of its usable life, its journey continues.

100% cotton products can be mechanically or chemically recycled back into new fiber.



This fiber can then be transformed into new textiles, home goods, nonwovens, insulation, or even inputs for 3D printing and injection molding.

Cotton's [Blue Jeans Go Green™](#) denim recycling program showcases this process in action. For two decades, old denim has been collected and transformed into a non-woven insulating material used in various applications from building insulation, industrial and pet bed inserts, and even cold-chain packaging.

¹ Egbuta, M.A., McIntosh, S., Waters, D.L., Vancov, T., Liu, L. (2017). Biological Importance of Cotton By-Products Relative to Chemical Constituents of the Cotton Plant. *Molecules*, 22(1), 93. <https://doi.org/10.3390/molecules22010093>

² Daniel, D. R. (2003). The chemical and functional properties of cottonseed oil as a deep-fat frying medium [Doctoral dissertation, Texas Tech University, p. 9]. <https://ttu-ir.tdl.org/server/api/core/bitstreams/dc1f21a4-7895-4a5d-bc82-b9f04ad1771f/content>

³ Cottonseedoil. COTTON: A Versatile "And" Crop. Retrieved September 2025, from <https://www.cottonseedoil.org/about/cotton-a-versatile-and-crop/>

⁴ Bales, A. M., dos Santos Neto, J. M., & Lock, A. L. (2024). Effect of increasing dietary inclusion of whole cottonseed on nutrient digestibility and milk production of high-producing dairy cows. *Journal of Dairy Science*, 107:7798–7809. <https://doi.org/10.3168/jds.2024-24787>

⁵ Mullenix, M.K., Stewart Jr., R.L., Jacobs, J.L., Davis, D.L. (2022). Invited Review: Using whole cottonseed and cotton harvest residue in southeastern US beef cattle diets: Quality, intake, and changes in feed characteristics. *Applied Animal Science*, 38:447-455. <https://doi.org/10.15232/aas.2022-02301>

Returning to Earth: Biodegradability and Composting

As a natural fiber, cotton is designed to return to the soil.

Rapid Biodegradation: Cotton biodegrades reliably across different environments, including soil, freshwater, and marine ecosystems. In water, unfinished cotton often breaks down at similar rate as natural oak leaves, losing more than 70% of its mass within a month under activated sludge conditions.⁶ Even with common textile treatments,⁶ cotton's biodegradability remains effective.

Nutrient-Rich Compost: Composting cotton textile waste, such as denim scraps, can create nutrient-rich compost in under three months.⁸ This process regenerates soil and avoids the release of methane, a potent greenhouse gas produced when textiles decompose in landfills.⁹ A 2023 Cornell University study demonstrated this by burying denim in a compost pile; the cotton biodegraded within months, leaving only the synthetic threads behind.⁸

Avoiding Microplastic Pollution: This natural biodegradability offers a critical advantage over synthetic fibers like polyester, which are derived from petroleum and persist for centuries as plastic pollution. Recent studies on microfiber shedding highlight this difference: when cotton-polyester garments are washed, the cotton fibers biodegrade in about a month, while the polyester fibers remain, polluting our soil and waterways for decades.⁷ This inherent quality protects our soil and waterways from plastic pollution.

What new technologies are advancing cotton's circularity?

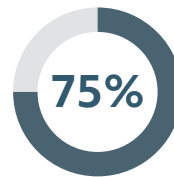
Innovation is unlocking new pathways to circularity for cotton waste.

- **Cotton-to-Glucose:** Emerging technologies can convert cotton textile waste into glucose.¹⁰ This opens the door to creating new bio-based materials for products like detergents and cosmetics, further closing the material loop.

- **Bioenergy:** Cotton ginning byproducts and textile scraps can be processed into bioenergy. The 50 million metric tons of cotton stalk residues generated globally each year¹¹ could potentially produce about 118 TWh of bioenergy.^{11,12,13} In addition, the roughly 17 million metric tons of cotton textile waste generated annually could supply another 40 TWh.^{12,13,14,15,16} Together, this 158 TWh of potential energy would be enough to meet the annual household electricity needs of nearly 15 million U.S. homes^{17,18}—enough to power the combined households of New York, Los Angeles, and Chicago.¹⁴
- **Biochar:** Through a process called pyrolysis, cotton stalks can be converted into biochar, a stable, carbon-rich solid. When added to soil, biochar sequesters carbon long-term and improves land health. Cotton stalk biochar has a carbon sequestration potential of 24%, outperforming biochar from other agricultural residues.¹⁹

What are the main benefits of cotton's circularity for the environment and consumers?

- **Reduces Landfill Burden:** By enabling reuse, recycling, and composting, cotton diverts waste from landfills, mitigating the production of harmful methane emissions.
- **Enhances Soil Health:** Composting and biochar production return vital nutrients and carbon to the soil, supporting regenerative agriculture and future crop productivity.
- **Aligns with Consumer Values:** Consumers increasingly connect cotton with sustainability.



A recent survey found that **75% of consumers associate cotton with circularity and want to see it used more widely in clothing.**²⁰

For more information on cotton and circularity, visit cottontoday.cottoninc.com



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