Material Scenario
Cotton fiber that is grown, processed, and certified according to organic standards. Unit processes for the production of cotton begin with the seed at field, cultivation, and ginning. Processing of cotton includes processes such as opening, cleaning, mixing, carding or combing, drawing, roving, spinning, and weaving or knitting the fabric.

Certified organic cotton is produced in accordance with specific country-level or international organic agricultural standards, integrating ecological processes, and avoiding the use of toxic and persistent synthetic pesticides and fertilizers as well as genetically modified seeds. Independent certification agencies accredited by organizations that maintain strict controls over certifiers are responsible for certifying organic cotton according to standards. To maintain certification through processing to final product, the organic cotton must be kept separate from non-certified cotton and be traceable from the farm to the finished product (Textile Exchange, n.d.).

Common Uses In Apparel And Footwear
Cotton is a widely used fiber with applications for nearly all types of apparel and selected types of footwear. It is widespread in men’s, women’s and children’s clothing and is used in uppers and shoelaces for footwear. In addition to its use in 100% cotton textiles, it is also blended in various combinations with polyester, spandex, rayon, and hemp as well as other fibers (Guruprasad, n.d.).

Alternative Textiles That May Be Substituted For Material
• Hemp • Linen • Modal • Polyester • Rayon • Tencel (Lyocell)

Life Cycle Description
Functional Unit
1 kilogram of woven or knit organic cotton greige fabric

System Boundary
Cradle to undyed fabric. The data presented within include all steps required to turn the raw material or initial stock into undyed knit or woven fabric, including transportation and energy inputs. Capital equipment, space conditioning, support personnel requirements, and miscellaneous materials comprising <1% by weight of net process inputs are excluded.
Allocation

Ginning of harvested cotton (known as seed cotton) produces one unit of higher economic value cotton fiber (lint) along with 1.4 units of substantially lower economic value cottonseed. Cotton combing prior to spinning creates a co-product, noils, that are short fibers with an economic value that is about half that of cotton lint (Cotton Inc., 2012a, p. 21). Stalks and gin waste are considered waste materials and are assigned no burden.

Unit Process Descriptions

Material Sourcing

Organic cotton growing differs in a number of critical aspects compared with methods for growing conventional cotton (Klonsky, 1995, p. 2) – primarily in bringing a systems focus to farming through building soil health, the use of mixed cropping systems and crop rotation, and the avoidance of fossil fuel-based, toxic, and persistent agricultural chemicals and the use of genetically modified seed (Textile Exchange, 2010, p. 3, Guerena and Sullivan, 2003). Organic cotton fiber must be certified by an accredited independent organization as meeting country specific or international organic farm standards established by a recognized authoritative organization.

Global organic production for the 2013-14 growing season covered 220,765 hectares of land, producing 116,974 metric tons (MT) of lint (Textile Exchange, 2015a, p. 25). Cotton may be grown using organic methods in similar regions as conventional cotton crops where temperate to hot conditions with long growing seasons exist (Kadolph, 2007, p. 42). Nineteen countries worldwide produced organic cotton in 2013-14, with the top five producing countries accounting for 96% of total production. India alone produced 74%, followed by, China, Turkey, Tanzania, and the U.S. at 10%, 7%, 3%, and 2% respectively (Textile Exchange, 2015a, p. 20).

Figure 1: Organic Cotton Global Production

Source: Textile Exchange, 2015a, p. 26
India recorded 86,853 MT of fiber production in 2013-14, a growth of 7% from the previous year.

China recorded 12,232 MT of fiber production in 2013-14, a growth of 19% from the previous year.
Turkey recorded 7,958 MT of fiber production in 2013/4, a growth of 12% from the previous year.

Tanzania recorded 3,752 MT of fiber production in 2013-14, a growth of 11% from the previous year.
The U.S. recorded 2,415 MT of fiber production in 2013-14, a growth of 25% from the previous year.

Organic methods seek to establish a self-regulating farm ecosystem that uses on-farm inputs such as green manure, biomass, organic fertilizers and botanical preparations, while minimizing the use of external resources (Textile Exchange, 2010, p. 3). In lieu of using synthetic agri-chemicals to control pests, biological and cultural controls are used based on an understanding of local ecology and adjusting products to complement natural systems (Guerena and Sullivan, 2003). Where external resources are required, such as B.t. (B. thuringiensis) sprays, or elemental sulfur, they must be approved for organic farming use.

Seed cotton must not be treated with any synthetic chemicals, but may utilize biological fungicides, a polymer coating, and calcium carbonate to protect the seeds (Blackburn, 2009, p. 252).

Successful organic production rests on creating and maintaining soil health and fertility to support desired cotton yields. The organic production system strives to minimize external inputs and to make use of farm-own resources (e.g. animal and green manures, biomass, organic fertilizers, and botanical preparations for pest control) thus preventing toxic exposure to humans and bioaccumulation in the environment. Crop rotation and the use of cover crops such as legumes, grains, and grasses are planted to replenish soil nitrogen and reduce nutrient loss (Rangarajan, n.d.). Manure fertilizers, particularly from poultry, provide additional nitrogen for organic production (Blackburn, 2009, p. 244).

Organic cotton can only be certified if conventional chemical pesticides and fertilizers have not been used for three consecutive years on the land where the crop is grown (Blackburn, 2009, p. 233).

Though a yield gap may occur, yields are found to increase over time and with improved management (Forster, 2013, p. 7).
Processing Cotton Lint Into Spun Yarn

Certification of organic cotton requires that the cotton be tracked from the field through all subsequent manufacturing steps and be processed on machines that are either thoroughly cleaned prior to being used for organic cotton or used exclusively for organic cotton to ensure segregation from conventional cotton and any associated contaminants (Blackburn, 2009, p. 263). Organic cotton must also be stored separately if conventional cotton is processed on a site.

Certified organic cotton fiber may be used to manufacture a textile with the same processes and chemical inputs as non-certified fiber; the resulting textiles and products can claim organic fiber content through Textile Exchange’s Organic Content Standard (OCS).

Organic certification is available for post-harvest processing and textile manufacturing using the Global Organic Textile Standard (GOTS), which addresses social and environmental issues in textiles made with at least 70% certified organic natural fibers. GOTS covers chemical inputs, management policies and procedures, social criteria, technical performance qualities, and residues in textiles. Independent certification is required (GOTS IWG, 2014).

Cotton lint, conventional or organic, must be cleaned of dirt and plant matter, and must first be opened from the packed bale. This process loosens the fibers and blends fibers from multiple bales. Very short fibers, debris, and other detritus are removed during this stage. After the fibers are prepared, they are carded to align and remove remaining contaminants and turned into slivers (Kadolph, 2007, p. 182). The slivers are then drawn through consecutive rollers that improve the alignment of the fibers. Long-staple fibers undergo a combing process, which removes short fibers and further improves the uniformity of the sliver. Drawing occurs before and twice after the combing process (Kadolph, 2007, p. 183).

Spinning may be done on rings, open-ended rotors or via other methods. Ring-spun cotton is the most common form of transforming parallel fibers into yarn. They are drawn into strands and twisted to improve tensile strength (Kadolph, 2007, p. 185). Open-end spinning is the other major spinning method.

Textile Construction

Spun yarn can either be woven or knit into a textile.

Woven textiles are produced on looms that combine warp yarns with filling yarns to produce a stable fabric. The type of loom used in the weaving process determines the environmental impacts: water-jet looms have high water usage, though it is reclaimed, but the fabric must be dried before storage, increasing energy consumption (Kadolph, 2007, p. 221).

Knitting is done by machines that loop yarns together to create a more flexible textile. Knitting requires significantly less energy than weaving, with a 20-fold decrease in energy demand (van der Velden, 2013, p. 347). Vibration, lint, noise and energy are all lower on knitting machines than for weaving looms (Kadolph, 2007, p. 270). Knitting oils are added to fabric to improve machine efficiency; the oils are scoured during the dyeing and finishing process (Blackburn, 2009, p. 265).

Textiles that are GOTS certified have limits on the chemicals used for sizing of weaving yarns; size is then removed during the dyeing and finishing process (Blackburn, 2009, p. 265). Projectile looms are low energy, accounting for half as much energy as rapier looms, and a third as much as air-jet looms (Kadolph, 2007, p. 221).
Process Inputs

Energy

To produce 1 kg of organic cotton, as a global average, 5.8 MJ of energy is required (Textile Exchange, 2014a, p. 42). The Potential Energy Demand (PED) for conventional cotton\(^1\) is ca. 15 MJ/kg lint cotton (Cotton Inc., 2012a, p. 11). This results in a reduced PED (non-renewable) of 62%. Avoiding the use of mineral fertilizer reduces the Global Warming Potential (GWP), since mineral fertilizers are petroleum-derived and carry a high PED.

Cotton from cradle-to-gate (up to undyed woven fabric) requires various energies depending on fineness of yarn: between 450 MJ/kg for 70 dtex yarn to 150 MJ/kg for 300 dtex yarn (van der Velden, 2013, p. 350).

Soil

Cotton can be grown in many soils, but deep medium to heavy soils are best, and soil should retain water well (Kooistra, 2006, p. 5).

Popular techniques for improving soil fertility include crop rotation, intercropping, composting and by planting cover crops following the harvest (Textile Exchange 2015a; Rangarajan, n.d.).

Water

Defined as marketable crop yield over evapotranspiration, cotton has one of the lowest crop water productivities (CWPs) of any agricultural crop.

Organic cotton is mostly rain-fed (Kooistra, 2006, p. xii; Textile Exchange, 2014a, p. 40), estimated at about 75-80% of production (Textile Exchange, 2013, p. 34). The global average for Water Consumption (WC), the impact category with a high environmental relevance, for organic cotton, is 182 liters/kg lint, which is significantly less than that of conventional cotton at 2,120 liters/kg lint (Textile Exchange, 2014a, p. 40).

Water use is limited to approximately 50 liters/kg fabric in the later stages of the cradle-to-gate life cycle (Textile Exchange, 2012, p. 89). Water may be used to humidify mills, apply sizing, and in water-jet looms.

Chemical

Synthetic (fossil fuel-based) chemicals and toxic and persistent chemicals are prohibited in organic farming. Pests are controlled through appropriate crop rotation, carefully selected plant varieties, increased monitoring, beneficial insects, bio- and mineral-based pesticides, constructed traps, trap crops, and selective hand removal (Textile Exchange, 2008, pp. 1, 6). Rates of use vary depending on local conditions, farmer knowledge, skill, and access to training. Bio and certain mineral-based substances are allowed. In very limited cases, select synthetic chemicals may be used if approved by the certifying organization (Blackburn, 2009, p. 232).

Defoliants commonly used to prepare cotton bolls for mechanical harvest are mostly synthetic and thus unavailable for organic cotton. Alternatives to chemicals include thermal defoliation, controlling water applications in low precipitation regions, and waiting for frost in temperate climates (Blackburn, 2009, p. 262).

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\(^1\) In this Snapshot, comparisons have been made between organic cotton and conventional. Values were derived from two independent peer-reviewed studies whose comparability has not been verified. Therefore, the comparison is of indicative value only.
Organic farming aims to create self-stabilizing agro-ecosystems with the help of suitable crop rotations, mixed cropping systems, choice of adapted varieties, and application of organic fertilizers and manures. Pest outbreaks are to some degree minimised by the ecological balance maintained by the organic system or through the use of trap crops. Further, native plants are often used for farm borders, preserving populations of local species. This results in increased biodiversity, soil fertility and, in some cases, habitat restoration. In addition, as genetically modified organisms are banned, continuation of indigenous species is more likely, and the lack of chemicals reduces the risk of harm to biodiversity.

Cotton yarns are usually sized before weaving to reduce lint releases and damage to the resulting textile. Knit textiles use little or no lubricating compounds as they do not abrade during the process (Kadolph, 2007, p. 221). Processing following GOTS limits the use of size to bio-based materials.


**Physical**

The physical inputs into cotton cultivation are the seed used to sow each year’s new crop, seeds for cover and trap crops, beneficial insects, and, in the case of surface drip irrigated cotton, regular replacement of polyethylene tubing (Cotton Inc., n.d.). Compressed air is used in mills.

**Land-use Intensity**

About 3% of the global agricultural acreage is dedicated to cotton cultivation (Cotton Inc., 2012b, p. 5). Organic production in 2013-14 crop year was 220,765 ha (Textile Exchange, 2015a, p. 25). The most popular crop varieties grown in rotation with, or alongside, cotton are cereals and grains followed by legumes and pulses (Textile Exchange, 2015b, pp. 14, 27). Depending on the strategies a farmer may use, organic cotton may be planted less densely to encourage plant growth and beneficial co-species, as well as to discourage pests; conversely, denser plantings may help shade out weeds (Blackburn, 2009, p. 253).

From the recent Organic Cotton Sustainability Assessment Tool (OC-SAT) (Textile Exchange, 2015b, p. 19) findings showed that farmers grow a variety of crops alongside organic cotton. This indicates the diversity of land-use and the low practice of monocropping (Textile Exchange, 2015b) within organic farming systems.

While intensification of cotton crops has resulted in decreased land-use intensity, globally, an estimated 4-5% of arable land has been abandoned due to intense cultivation of (conventional) cotton (Kooistra, 2006, p. xi).

![Figure 7: Crops Grown Alongside Organic Cotton](source: Textile Exchange, 2015b, p. 19)
Process Outputs

Co-products & By-products

Secondary co-products of ginning include cottonseed used for oil, animal feed, cosmetics, and fertilizer and linters, which are very short fibers used in the production of rayon, acetate, cellophane, fingernail polish, and methylcellulose (Kadolph, 2007, p. 43). Yarn spinning creates a secondary co-product, noils, that also have economic value (Cotton Inc., 2012a, p. 20).

In addition, organic co-products may have increased economic value to the food industry (e.g. organic rotation crops such as sesame, wheat, soya). Organic cottonseed can also have increased market value and sold as feed to organic dairies. A portion of the crop may also be saved for replanting (USDA, 2014, p. 1).

Solid Waste

At every stage, from harvest to fiber to fabric, there is a loss of material that does not have any economic value. Major cotton wastes include cotton stalks, gin waste, and fabric selvage associated with textile weaving or knitting (Cotton Inc., 2012a, p. 20). Stalks are often composted in organic systems or reused as part of conservation tillage, and gin waste and fabric scraps can be recycled into other cotton products. Abraded fiber from spinning and weaving/knitting processes also ends up as waste (Kadolph, 2007, p. 221). Other solid wastes are associated with packaging of cotton as it moves through the life cycle via transportation.

Hazardous Waste/Toxicity

Inherent in organic farming is the avoidance of synthetic pesticides and fertilizers that may result in the generation of hazardous waste from farm operations. Moreover, the use of toxic and persistent chemicals is avoided as well. Little, if any, hazardous waste or toxic materials are used in post-harvest cotton processing and greige manufacture.

The global average Eutrophication Potential (EP) of organic cotton fiber is calculated to be 0.0028 kg PO$_4^{3-}$ equivalent per 1 kg fiber (Textile Exchange, 2014a). Eutrophication Potential of conventional cotton fiber is calculated at 0.0038 kg PO$_4^{3-}$ equivalent per 1 kg fiber (Cotton Inc., 2012a, p. 11).

Globally, Acidification Potential (AP) for organic cotton was 0.0057 kg SO$_2$ equivalent for 1 kg lint cotton (Textile Exchange, 2014a). The acidification potential reported for conventional cotton is 0.0187 kg SO$_2$ equivalent for 1 kg lint (Cotton Inc. 2012). This difference is driven by reduced or avoided agricultural inputs in organic cotton systems, i.e. fertilizer and pesticide production, irrigation pumps and tractor operations. The difference is also caused by differences in field emissions due to the different amounts of nutrients applied (Textile Exchange, 2014a).

Wastewater

Organic cotton is predominantly rain-fed but when irrigation is used, large volumes of wastewater runoff may result; as much as 50% of applied water (Montgomery and Wigginton, n.d.). Runoff typically contains fertilizers and pesticides (Chapagain, et al., 2006, p. 192), although a recent study showed that organic farming practices have a much lower grey (polluted) water footprint, and therefore a lower impact on water resources than conventional farming while having similar land productivities (Water Footprint Network, 2013, p. 23).
Emissions

On average, organic cotton cultivation causes 0.98 kg CO₂ equivalent for every 1 kg of cotton fiber produced (Textile Exchange, 2014a, p. 55). This compares to 1.81 kg CO₂ equivalent/1 kg of fiber for conventional cotton (Cotton Inc., 2012a, p. 11; Textile Exchange, 2014a, p. 52). Key sources of GHG emissions in organic cotton production are fuel use for farm equipment, electricity use primarily for pumping water, and nitrous oxide emissions associated with nitrogen-based fertilizers. Manure contributes to GHG emissions due to ruminant emissions of methane, manure emissions and soil development of nitrous oxide (Chadwick, 2011, p. 1). An estimated 44 kg of nitrogen is applied as the active ingredient of organic fertilizer per hectare of cultivation (Textile Exchange, 2014a, p. 74). All other steps of processing require the same equipment and thus likely have similar emissions (Blackburn, 2009, p. 264).

<table>
<thead>
<tr>
<th>Performance And Processing</th>
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</thead>
<tbody>
<tr>
<td>Functional Attributes And Performance</td>
</tr>
<tr>
<td>• Absorbent</td>
</tr>
<tr>
<td>• Machine washable</td>
</tr>
<tr>
<td>• Resistant to high heat</td>
</tr>
<tr>
<td>• No static buildup</td>
</tr>
<tr>
<td>• Stronger when wet</td>
</tr>
<tr>
<td>• Soft hand feel</td>
</tr>
</tbody>
</table>
Mechanical Attributes

Cotton staple length determines the fineness of the final product. Higher amounts of glucose monomers within a long linear chain that make up each fiber improves fiber strength (Kadolph, 2007, p. 46). Cotton is relatively strong, with a dry breaking tenacity of 3.5-4.0 grams/denier, and is 30% stronger when wet. Resiliency in cotton is very low due to weak hydrogen bonds, causing degradation and frequent wrinkling (Kadolph, 2007, p. 47). Cotton may be mercerized to improve absorbency and improve dyeability. Fabrics made from entirely cotton yarn will shrink, especially when treated in hot water. They have an elastic recovery of about 75% from a 2-5% stretch (Kadolph, 2007, p. 47). Color of the fiber ranges between white and yellow, and is also graded on reflectivity. Color of the fiber ranges between white and yellow, and is also graded on reflectivity.

Processing Characteristics

Cotton that contains remnants of leaves, dirt, and other agricultural by-products will result in lower quality fabric (Kadolph, 2007, p. 46). Immature and coarse fibers also degrade the character of cotton, reducing fineness and can cause defects in fabrics.

Aesthetics

Cotton can be sorted by staple length, character, and grade. Staple length determines the quality, and longer staples produce softer, smoother, stronger fabrics with higher luster (Kadolph, 2007, p. 47). Cotton has relatively short length for a fiber, but contains convolutions that improve the tensile adhesion between fibers (Kadolph, 2007, p. 47).

Potential Social And Ethical Concerns

Organic cotton cultivation aims to reduce or eliminate environmental, ethical, and social concerns caused by conventional cotton production (IFOAM, n.d.). Organic cotton aims to promote protection of ecosystems as well as improve economic fairness, transparency, and ethical production and sourcing (Textile Exchange, 2013, p. 9).

According to the recent Organic Cotton Sustainability Assessment Tool (OC-SAT), all organic cotton producer groups surveyed reported to have developed, or to be working in compliance with, some sort of labor policy. 46% of producer groups are Fairtrade certified and the remaining 54% have either established formal labor standards and policies (36%) or adhere to their own informal labor standards (64%). In all, 65% either have Fairtrade certification or have developed formal labor policies (Textile Exchange, 2015b).

The Global Organic Textile Standard requires social criteria to be met through the supply chain for organic certification (GOTS, 2014, p. 27).

### Table 2. Fiber Properties Of (Conventional U.S.) Cotton

<table>
<thead>
<tr>
<th>Fiber Properties</th>
<th>U.S. Cotton</th>
</tr>
</thead>
<tbody>
<tr>
<td>Staple length (mm)</td>
<td>22.2 - 38.1</td>
</tr>
<tr>
<td>Tenacity (g/d)</td>
<td>3.5 - 4.0</td>
</tr>
<tr>
<td>Tensile strain (%)</td>
<td>3 - 7</td>
</tr>
<tr>
<td>Water retention (%)</td>
<td>7 - 11</td>
</tr>
<tr>
<td>Breaking stress - Dry (cN/tex)</td>
<td>26 - 43</td>
</tr>
<tr>
<td>Breaking stress - Wet (cN/tex)</td>
<td>26 - 47</td>
</tr>
<tr>
<td>Fineness (dtex)</td>
<td>1.2 - 2.8</td>
</tr>
<tr>
<td>Ignition temperature (°C)</td>
<td>390</td>
</tr>
</tbody>
</table>

References

i Kadolph, 2007, p. 43, 47
ii Ziva and Krste 2010, p. 28
iii Brandrup et al., 2009, pp. 142, 147

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**Fiber Properties**

- **U.S. Cotton**
  - **Staple length:** 22.2 - 38.1 mm
  - **Tenacity (g/d):** 3.5 - 4.0
  - **Tensile strain (%):** 3 - 7
  - **Water retention (%):** 7 - 11
  - **Breaking stress - Dry (cN/tex):** 26 - 43
  - **Breaking stress - Wet (cN/tex):** 26 - 47
  - **Fineness (dtex):** 1.2 - 2.8
  - **Ignition temperature (°C):** 390

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**References**

i Kadolph, 2007, p. 43, 47
ii Ziva and Krste 2010, p. 28
iii Brandrup et al., 2009, pp. 142, 147
Social and ethical concerns for cotton grown and processed conventionally include potential harmful exposures to hazardous chemicals used in farming and exposure to cotton fibers in subsequent processing. Chinese and Indian cultivation is largely performed by hand, which may lead to a variety of ergonomic injuries (Cotton Inc., 2012b, p. 41). Uncontrolled exposures to cotton lint may cause byssinosis, a debilitating lung disease (USDoL, n.d.). Human exposures may occur to on-site workers as well as surrounding communities due to pesticide drift and through pesticide and fertilizer contaminated water; similarly ecosystem exposures to flora and fauna occur on and off the farm and have contributed to hypoxia of surface waters and marine environments (USEPA, n.d.).

Intensive tillage tends to lead to topsoil erosion reducing future agricultural productivity, although an increasing number of farms are using low and no tillage practices (Rust and Williams, n.d.). The intensity of water use may compete with food crops in water scarce areas (Strom, 2014).

Chinese farmers report frequent pesticide poisoning, with 27% having reported experiencing effects (Liu, 2012, p. 204). Forced and child labor have been reported as occurring in China in violation of international standards (USDoL, 2014, p. 4). However, very little data exists that examines the use of children in cotton cultivation, though incidences have been documented (Ergon, 2008, p. 55).

India has the highest known labor inputs required for cotton cultivation, at 190-225 labor days required per hectare annually (Ergon, 2008, p. 29). Employment in cotton cultivation can be marginal, with many workers working for wages or in-kind, with limited access to labor protections or worker’s rights. (Ergon, 2008, p. 33). Child labor is also an issue, particularly around cottonseed production (D. Venkateswarlu, 2010).

Suicide rates in India are elevated among “marginal farmers” with capital intensive cash crops subject to price fluctuations (such as cotton) and who are working small plots and carrying significant debt loads (Kennedy and King, 2014, p. 8).

While 75-80% of organic cotton crops are rain-fed (Textile Exchange, 2013, p. 34), crops that do receive irrigation compete with residential and industrial demand for extremely limited water resources in water-stressed areas (Shiao et al., 2015).

### Availability Of Material

Organic cotton production increased by 10% in the 2013-14 production year after having fallen in the three previous years due to drought in the United States and South America, and social unrest in Syria, formerly the world’s second largest organic producer (Textile Exchange, 2015a, p. 25; Textile Exchange, 2013, p.16). Consistent and stable organic cotton production has been a challenge globally (Textile Exchange, 2013, p. 24), mostly due to farmer price margins and market uncertainty. A 2015 market survey indicated that there is rising demand from brands and retailers, leading to growth in the market share held by organic cotton (Textile Exchange, 2015a, p. 5).

### Availability Of Certified Materials

Organic farming standards are typically established by national bodies. Organic cotton fiber is certified through a variety of organizations, which must ensure compliance to applicable country or regional standards. Certifying bodies must be accredited by a recognized authority (e.g., IFOAM, APEDA, USDA) so that they meet standards and norms for certification. In the United States, the Department of Agriculture sets standards for organic material in the U.S., accredits certification organizations (approximately 80 as of May 2015, USDA, 2015, p. 1), and has agreements with certain countries to accept products certified to their organic standards (USDA, 2013).

To ensure the chain of custody through the supply chain, two standards are available.

The Organic Content Standard (OCS) relies on third-party certification to verify that a final product contains the accurate amount of a given organically grown material. It does not address the use of chemicals or any social or environmental aspects of production beyond the integrity of the organic material, and references national and IFOAM organic farm standards. The OCS uses the chain of custody requirements of the Content Claim Standard (CCS).
The number of OCS certified facilities recently increased by 26%, from 2,516 facilities in 2013 to 3,170 in 2014. OCS certified facilities are located in 45 countries around the world. The top ten countries in terms of total number of OCS certified facilities are: India, Bangladesh, China, Turkey, South Korea, Japan, Pakistan, Hong Kong and Sri Lanka (Textile Exchange, 2015a, p. 21).

The Global Organic Textile Standard (GOTS) covers the processing, manufacturing, packaging, labeling, trading and distribution of all textiles made from at least 70% certified organic natural fibers. The final products may include, but are not limited to, fiber products, yarns, fabrics, clothes and home textiles. GOTS is developed and maintained by the Global Organic Textile Standard International Working Group (GOTS, 2014, p. 4). The International Working Group also approves certification organizations that assess and audit compliance with GOTS (GOTS, n.d.).

The number of GOTS certified facilities recently grew by more than 18%, from 3,085 facilities in 2013 to 3,663 facilities in 2014. GOTS certified facilities are now located in 64 countries around the world. The top ten countries in terms of the total number of GOTS-certified facilities are: India, Turkey, Germany, China, Bangladesh, Pakistan, Italy, South Korea, Portugal and Japan (Textile Exchange, 2015a, p. 21).

Cost Of Textile

Similar to other commodities, conventionally grown cotton prices can be volatile depending on supply and demand factors and on governmental subsidies and policies (Blackburn, p. 35). Organic cotton pricing varies; in some locations a price “premium” (organic price) is added to the equivalent conventional cotton price. In other case, organic cotton fiber is considered a specialty product and priced independently of the commodity cotton market, which usually results in less volatile prices.

Organic cotton fiber prices in the 2013-14 marketing year were $2.08 to $3.20/kg for Chinese organic fiber, $1.60 to 2.15 /kg for Turkish organic fiber, $2.60 to $3.40/kg for U.S. organic fiber, and an average of $1.52/ kg for Indian organic fiber (Textile Exchange, 2015a, pp. 32, 42, 43; Organic Trade Association, 2015, p. 4).

Questions To Ask When Sourcing This Material

Q: Where is the cotton grown?

Q: Is there an organic certificate available for the cotton fiber?

Q: Who is the organic certifier?

Q: What organic standard is the cotton certified to?

Q: What entity accredited the certifier?

Q: Is the processing certified to GOTS?

Q: Who is the certifying entity?

Q: Is there chain of custody documentation available?

Q: Is the cotton Fairtrade and what entity certified it?
Figure 8. System Diagram Of Organic Cotton

- Organic Seed Cotton
  - Transportation
  - Energy
  - Transportation
  - Irrigation
  - Fertilizers
  - Pest Management
  - Weaving Aid Chemical
    - Water (Water-jet loom)
  - Spinning Aid Chemical
  - 1 kg Undyed Textile

- Cultivation
  - Fuel-related Emissions
- Ginning & Baling
  - Fuel-related Emissions
  - By-products (e.g. Polyethylene Tubing)
  - Solid Waste
- Opening
  - Fuel-related Emissions
  - By-products (e.g. Cottonseed)
  - Solid waste
- Cleaning
  - By-products (e.g. Linters)
  - Solid Waste
- Mixing
  - Greenhouse Gas Emissions
- Carding/ Combing
- Drawing
  - By-products (e.g. Linters)
  - Solid Waste
- Roving
- Spinning
  - By-products (e.g. Particulate Matter)
  - Solid Waste
- Finishing
  - By-products (e.g. Linters)
  - Solid Waste
  - Solid Waste
  - Wastewater
References


This guide is one of 27 Material Snapshots produced by Textile Exchange in 2015 with financial support from VF Corporation and in collaboration with Brown and Wilmanns Environmental, LLC. They are an extension of the original series released by TE in 2014.

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As a continual work in progress, this snapshot will be reviewed on a regular basis. We invite readers to provide feedback and suggestions for improvement, particularly with regards to data where new and improved sources are likely to emerge over time.

For more information please email Solutions@TextileExchange.org or visit: http://textileexchange.org/publications/#material-snapshots

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