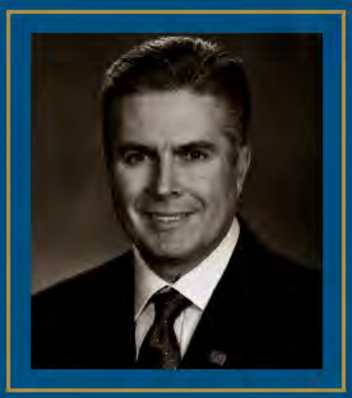

COTTON INCORPORATED
PIONEERS OF PROGRESS

The cover illustration, which is styled after a vintage almanac cover, presents the many products that are made from the cotton plant: from apparel to food products, to paper money. It is complemented by the photography inside the book, which helps to illustrate the cotton industry's ongoing commitment to responsible production and manufacturing practices. Many of the photographs were contributed by cotton growers, gin and mill employees and other members of the extended cotton family.

Cotton
Incorporated

SINCE IT WAS FOUNDED IN 1970 THROUGH TO THE PRESENT DAY, THE PROGRAMS OF COTTON INCORPORATED HELP THE COTTON INDUSTRY REALIZE ITS COMMITMENT TO SUSTAINABLE PRACTICES.



DEFINING SUSTAINABILITY

"Sustainability" is a word that has been heard more and more in recent years, almost exclusively in the context of environmental improvement. While there is no universally accepted definition of environmental sustainability, most agree that sustainable practices are those that are economical or profitable and, at the same time, help to minimize impact on the environment. This is how we define it at Cotton Incorporated, and our commitment to this point of view began long before the word took its current meaning.

Almost since we opened our doors, Cotton Incorporated began pioneering sustainable practices for U.S. cotton growers, as well as for businesses that process or manufacture cotton textiles. Then, as now, a key objective for the company was to identify innovations that could make cotton more profitable. An obvious path to this goal is finding ways to reduce the amount of chemicals required to grow cotton and process textiles. The simple logic is that, by reducing inputs, we also reduce costs associated with them and, at the same time, help reduce strain on the environment. Over time, the company has helped cotton growers and businesses on the global cotton supply chain realize real efficiencies and real environmental gains, and our work continues.

As the concept of sustainability became an integrated and integral facet of modern business, Cotton Incorporated formalized its commitment to sustainability. We became an active voice in the global sustainability community, sharing our knowledge with fellow members in well-known and well-respected sustainability organizations and learning from them in turn. Today, we remain committed to constructive dialogues on how cotton and its related industries can continue to be responsible stewards of the land.

This publication documents many of the environmental contributions Cotton Incorporated has made over the years. Perhaps the most visible of these is the first-ever, cradle-to-grave Life Cycle Assessment (LCA) of cotton garments, an accomplishment that is currently aiding industry sourcing decisions, guiding our own research projects, and existing as a benchmark to measure ongoing gains for the global industry. The LCA is neither the first nor the last contribution the company will make toward the long-term sustainability of the cotton industry.

Cotton Incorporated is justly proud of the projects summarized on the following pages and how our research efforts and outreach have been catalysts for positive environmental change, but we are not resting on our laurels. We do not see ourselves as pioneers of progress in retrospect, but as present-day instigators and collaborators for positive change that will benefit future generations.

J. Berrye Worsham
President & CEO

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reduced pesticide applications by

1/2

increased water use efficiency by

80%

PRODUCED MORE FIBER

without expanding acreage

AGRICULTURE

Since it was founded in 1970 through to the present day, the programs of Cotton Incorporated help the cotton industry realize its commitment to sustainable practices.

From an agricultural perspective, cotton is a commodity crop most widely known as an ingredient fiber in apparel and home textiles. Today, the global value of cotton fiber exceeds $6 billion per year. But cotton has uses and value beyond fiber in the form of cottonseed oil and meal, as well as other plant by-products, which add $1 billion annually. In many parts of the world, cotton is an economic essential: a cash crop that can thrive in hostile environments where food crops cannot flourish. Here in the United States, cotton production and processing employ more than 200,000 people, with an aggregate influence of $35 million on the gross domestic product.

Over the past 40 years, the work of the company's Agricultural & Environmental Research Division has been instrumental in improving grower efficiency—from collaborating on the development of better harvesting systems in the 1970s, to its role as a facilitator for scientists mapping the cotton genome today.

Every year, Cotton Incorporated supervises an average of 500 research projects, 400 of which are in agriculture. Most of these projects are focused specifically on optimizing efficiencies: decreasing inputs of fertilizer, pesticides and water and identifying optimal soil conservation management practices. These efforts have led to cotton growers' reducing the number of pesticide applications by half; increasing irrigation water use efficiency by 80%; and producing substantially greater amounts of fiber, without expanding acreage.

The environmental benefits are enhanced and validated by the transparency of grower practices. Cotton grown in the United States is among the most highly regulated in the world, requiring meticulous record keeping and reporting of chemical usage to the U.S. Environmental Protection Agency, the U.S. Food and Drug Administration, and governing bodies at the regional and state levels. The U.S. Department of Agriculture (USDA) and associated agencies, including the Economic Research Service (ERS), the Agricultural Research Service (ARS), the National Agricultural Statistics Service (NASS) and the Natural Resource Conservation Service (NRCS), also collect information on grower practices by conducting surveys on an ongoing basis and provide valuable resources and support for the implementation of conservation practices.

In addition, U.S. cotton growers conscientiously embrace any means to do their job better, from investing a share of their earnings to fund the activities of Cotton Incorporated, to their voluntary participation in studies to develop meaningful measures of environmental performance, which are key to establishing accurate benchmarks for cotton's environmental progress and to directing research where it will be most effective.

MODULE BUILDER TECHNOLOGY

One of the earliest environmentally themed projects for Cotton Incorporated was the evolution of the cotton harvest system. Until the mid-1940s, cotton was mostly picked by hand. Open trailers moved the harvested bolls from the field to the gin. When mechanical harvesting was introduced, the picking process accelerated, but ginning was slower to adapt. Farmers had to store the harvested cotton in trailers and would be forced to stop harvesting if the gin had not processed all their cotton when all the trailers were full.

Soon after its formation, Cotton Incorporated began working with Texas A&M University on a module building system, which enabled harvested cotton to be compacted and stored as a very large trapezoidal bale, 7.5 feet wide, 32 feet long and 11 feet high. These modules could stay in the field, covered by waterproof tarps, until the gin was ready to receive the harvested cotton.

Developers also worked on specialized haulers to move the modules from the field to the gin. Trucks were outfitted with tilted beds of parallel rows of conveyor chains that could load or unload the module in sync with the truck's speed. With these enhancements, the trucks could move modules at higher speeds for longer distances.

At the ginning stage, it quickly became apparent that the traditional system used to suction loose cotton would not be effective with the compressed modules. Developers created new systems that conveyed the entire module into a feeder that rapidly separated the cotton back into individual tuffs. Because of the significant increase in efficiency, the module builder, transporter and feeder combination was quickly adopted wherever cotton was mechanically harvested.

Advancements such as these have aided efficiency at the field level. Farmers now use wider harvesters that handle six to eight rows and employ carts known as boll buggies, which collect the cotton from the harvester and return it to the module builders. This process allows the pickers to spend 70% of the time on the row harvesting.

Some of the newest machines from Case IH and John Deere both pick the cotton and form the modules on the harvester. John Deere's version even triple-wraps the picked cotton in plastic before the round bales roll off the machine and onto the field.

Innovations such as the module builder and the ongoing work in optimizing the flow between field and gin have advanced cotton's sustainability by mitigating crop loss, reducing fuel use and fostering an efficient flow of fiber from the field through the gin.

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FROM EFFICIENCY TO SUSTAINABILITY

In the past 10 years, sustainability has become a key word across most industries. Yet Cotton Incorporated was practicing sustainability before it even had a name.

Still, the company knew it was essential that its data be credible and aligned along industry standards. To that end, Cotton Incorporated participates in a number of sustainability initiatives, including Field to Market: The Alliance for Sustainable Agriculture, a consortium of food companies, commodities, brands and retailers focused on reducing the impact of farming and making agriculture more environmentally friendly.

Early on, Cotton Incorporated recognized that reducing pesticide use was a priority because it presented both an economic and environmental cost to growers. Likewise, the company supported research into more efficient water use by producers.

Today, cotton production is highly efficient as a result of modern seed technology, conservation tillage practices, advanced scientific research, and machinery and equipment practices. All have combined to help U.S. farmers increase yield—two times more today than in the 1960s—on the same amount of cotton acreage. In fact, cotton is meeting 30% of the world's textile needs on 2.5% of agricultural land resources. Future fiber demand can be met on fixed land resources on the expectation of continued yield increase.

Field to Market released an independent research report that shows some impressive advances in the way cotton is grown. According to the Field to Market survey, the environmental impact of producing a pound of cotton in the United States has fallen substantially over the past three decades:

30%	68%	75%	31%	22%
improvement in land use efficiency	drop in soil loss	decline in irrigation water use	reduction in energy used	decrease in greenhouse gas (GHG) emissions

BOLL WEEVIL ERADICATION

In the early days of Cotton Incorporated, the company's scientists were adamant in combating the threat of the boll weevil. To understand their determination, it is important to note how devastating the insect was both to the environment and to the grower's bottom line.

The *Anthonomus grandis* (boll weevil) migrated from Mexico to the United States in the late 1800s and spread rapidly throughout the Cotton Belt. It was the single most destructive pest to the U.S. cotton industry, eventually costing producers more than $15 billion, both from yield losses and costs to control the insect.

In 1958, the National Cotton Council recognized the severity of the boll weevil's damage, and, with congressional leadership and support, the USDA Boll Weevil Research Lab was created. Eradication experiments and control programs were soon rolled out. In the late 1970s, the National Boll Weevil Eradication Program was launched along the Virginia–North Carolina border. The program soon expanded into other Southeastern states, followed by areas of Arizona, California and Mexico. Later programs were launched in Oklahoma, New Mexico, the Mid-South and Texas.

Cotton Incorporated was unequivocal in the need for grower commitment to the program, and its influence helped engage grower participation.

The eradication involved using three main techniques over a three- to five-year period: the laying of pheromone traps to detect the presence of the boll weevils, reducing the weevil's food supply and malathion applications. In its early days, all three techniques were employed in a tiered system. Today, it is much more sophisticated, using GPS mapping and bar-coded traps that can transmit data electronically.

These extensive efforts have resulted in the near-total eradication of the boll weevil throughout cotton-growing states in America. Today, the boll weevil has been eradicated in Virginia, North Carolina, South Carolina, Georgia, Florida, Alabama, Tennessee, Missouri, Arkansas and Mississippi. The Far West is also boll weevil free in California, Arizona, Oklahoma and New Mexico. In Texas, the pests were found in just three of the 16 eradication zones. Numbers have been reduced substantially in two of the zones and remained stable in the third.

There are numerous ecological benefits of the program; perhaps most significant is a reduced need for pesticide applications. Another advantage is that this allows other insects to survive, including natural predators to the boll weevil.

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INTRODUCTION OF BIOTECH COTTON

As devastating as the boll weevil was to the U.S. cotton industry—and still is to other countries—it was not the only pest to have a significant impact on cotton yield. Producers were also faced with attacks from tobacco budworms, cotton bollworms and pink bollworms. By the mid-1990s, invasions from these pests meant a 4% reduction in yields, or a quarter-billion dollars worth of cotton.

By the 1980s, insects had begun to evolve a tolerance to topically applied synthetic insecticides, just as scientists and environmentalists began to realize that improper use of synthetic chemicals had negative impacts on the environment and more benign options were needed.

After years of laboratory research and field trials by numerous scientists worldwide, a bacterium known as *Bacillus thuringiensis*, or *Bt*, which is harmless to animals and humans, was successfully incorporated into the DNA of the cotton plant.

Scientists knew *Bt* was a good candidate for biotech cotton because it had been used as an organic pesticide since 1920, primarily to kill flour moths, without any harmful effects to humans or the environment. Today, *Bt* is still approved for and widely used in organic farming.

As a liquid spray, *Bt* was not very effective for insect control because it was negatively affected by the weather: rain rapidly washed it away, and the sun degenerated its beneficial properties. Plants that expressed the *Bt* protein, however, did not need to be sprayed with chemical insecticides; pests that ate the plant either died or left the field in search of other sources of food.

Cotton Incorporated sponsored research at leading research universities, including Texas A&M and Texas Tech, to expedite a viable, bioengineered *Bt* protein, and, in 1996, commercial *Bt* cotton varieties became available to U.S. growers.

Prior to commercialization, the USEPA, the USDA and the FDA subjected *Bt* cotton, like every other biotech product, to rigorous regulatory evaluation. Comprehensive environmental and human safety studies were conducted, ruling out the possibility of harm to existing plants, nontarget organisms and humans.

From 1996 to 2007, 23% less insecticide active ingredient was used in *Bt*-adopting countries, and the resulting environmental impact from reduced insecticide use has fallen by 28%, as measured by the Environmental Impact Quotient (EIQ). Since the introduction of *Bt* cotton, the number of insecticide applications in the United States has been reduced by half. In 2008, 44% of U.S. cotton farms had fields that required no foliar insecticides. That same year, nearly one-third of U.S. cotton acreage required no additional insecticide applications.

Not only has *Bt* cotton reduced insecticide use, but it has also improved lint yield and reduced the costs to growers, who in turn spend less on insecticide supplies, equipment and labor. Additionally, *Bt* cotton has lowered the quantity of chemicals that enter the environment. Moving forward, the industry seeks to develop plants that are resistant to an even wider variety of insect pests.

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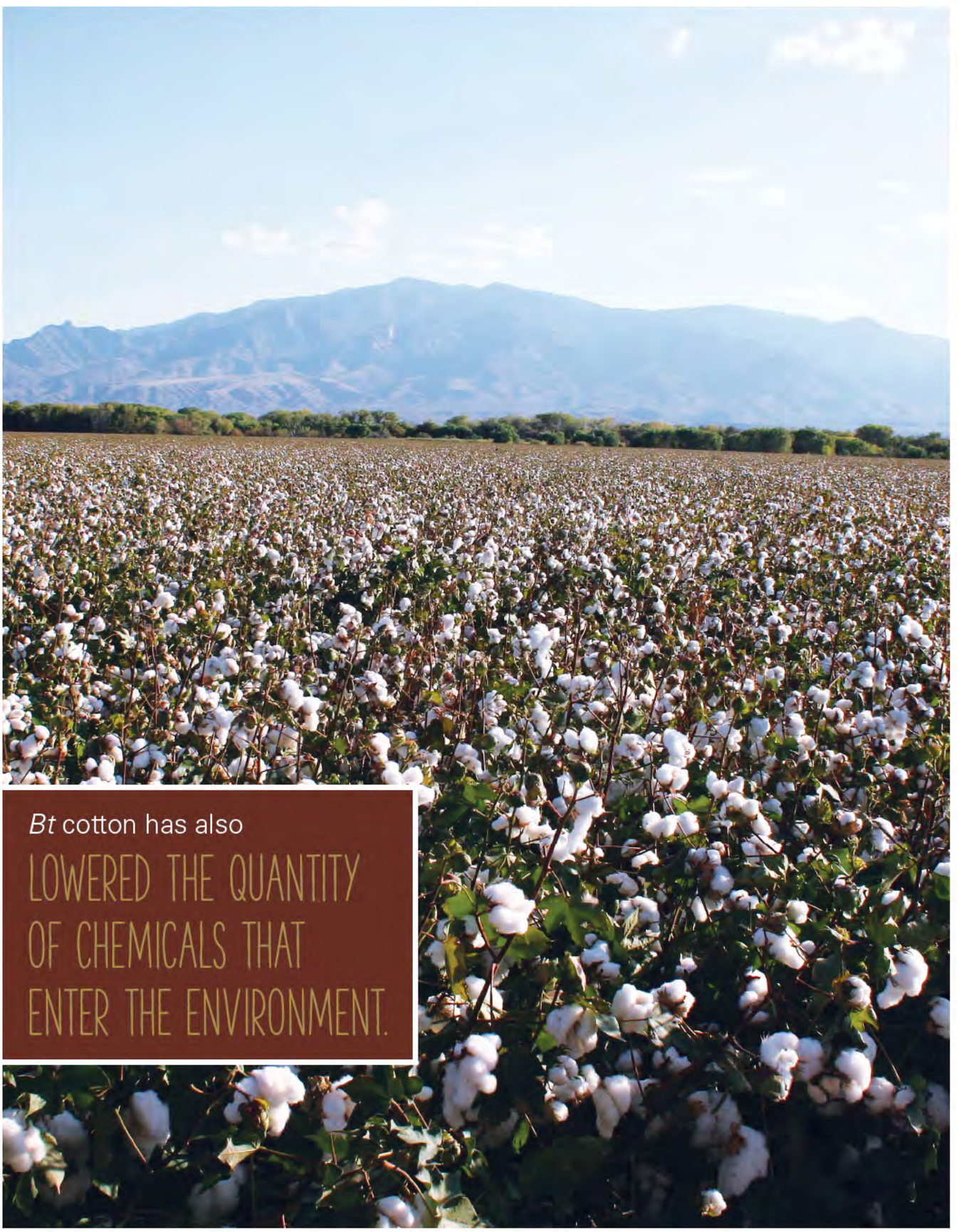

Bt cotton has also

LOWERED THE QUANTITY OF CHEMICALS THAT ENTER THE ENVIRONMENT.

ADVANCES IN PESTICIDES

Cotton Incorporated's Agricultural & Environmental Research Division continues to work with scientists and universities to reduce the use of pesticides.

Today, U.S. growers make 50% fewer pesticide applications than the generation before them, primarily because of the introduction of *Bt* cotton. According to data from *Cropnosis*, an independent company that monitors agrochemical sales around the world, the global cotton industry accounts for 6.24% of worldwide pesticide sales, 14% of which are insecticides. Fruits and vegetables account for 29%, and cereal crops, such as rice and corn, account for 35%. Consumers need not worry that there may be pesticide residues on their apparel or home goods. Cotton plants are most vulnerable to pests during the early growth stages, which means growers do not need to apply pesticides after the boll opens. In fact, since 1991, the Bremen Cotton Exchange has regularly tested raw cotton fiber from around the world for more than 200 toxic substances, including heavy metals and pesticides. U.S. cotton samples consistently receive an "n.d." ("not detected") designation. From a chemical residue standpoint, conventional raw U.S. cotton fiber is no different from organic cotton and satisfies OEKO-TEX® standards.

THE GLOBAL COTTON INDUSTRY ACCOUNTS FOR 6.24% OF WORLDWIDE PESTICIDE SALES,
14% of which are insecticides. Fruits and vegetables account for 29%, and cereal crops, such as rice and corn, account for 35%.

ADVANCES IN IRRIGATION

Cotton Incorporated is dedicated to preserving our planet's most valuable natural resource: water. It has taken steps to conserve water usage in both the growing and manufacturing phases.

Cotton is quite drought tolerant; 64% of U.S. cotton is grown with naturally occurring rainfall. Globally, cotton uses just 3% of the world's agricultural water.

In the United States, irrigation is mainly used to supplement rainfall during dry periods. Cotton Incorporated continues to develop more accurate ways to determine and deliver water to meet crop water needs when those dry periods do occur.

A number of methods are used to water cotton, including surface irrigation and sprinkler systems. One highly desirable delivery method is subsurface drip irrigation (SDI), which delivers water below the soil surface, thereby reducing evaporation. Studies have also shown that cotton grown using SDI watering methods had the highest water use efficiency for lint production.

Research also continues in finding ways to reduce water through effective measurement systems. One such system is the biologically identified optimal temperature interactive console (BIOTIC), developed by the scientists at the USDA ARS. The system provides irrigation scheduling based on measurement of canopy temperatures and the optimal temperature of a given crop species.

64% OF U.S. COTTON IS GROWN WITH NATURALLY OCCURRING RAINFALL.
Globally, cotton uses just 3% of the world's agricultural water.

SEQUENCING THE COTTON GENOME

Cotton Incorporated played an important role in facilitating the mapping of the cotton genome, an achievement that will greatly accelerate advancements in cotton genetics.

Both conventional breeders and geneticists believe this discovery will cut development time in half, thus expediting the availability of improved varieties of cotton, whether through genetic modification or conventional breeding. Cotton's genome sequencing stands as a toolbox for all cotton breeders, those who are breeding conventionally in a green house and geneticists in a lab.

It was more than a decade ago that cotton researchers discussed determining the appropriate path to sequence the genomes of *Gossypium*, the cotton genus. The community, through the International Cotton Genome Initiative, held open dialogue and ultimately determined the best route was first to sequence the diploid progenitor ancestors of Upland cotton.

While scientists from 31 institutions around the world were working on individual projects, Cotton Incorporated became extremely active in corralling and focusing this research, in addition to providing funding. In 2012, this consortium of scientists successfully mapped the two parent varieties of Upland cotton, the results of which were published in *Nature*.

The gold standard *Gossypium raimondii* genome sequence provides the reference blueprint that will revolutionize cotton genetic improvement over the next five to 10 years.

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INVESTMENT IN SUSTAINABILITY

Cotton Incorporated research and development, though, goes well beyond cotton fiber. The company is also exploring uses for the entire cotton plant in commercially viable, if unexpected, products.

Hydromulch

Though cotton is well known as an apparel and home goods textile fiber, it is increasingly being used in novel, yet beneficial and sustainable, applications. One such case is spray hydromulch, made from by-products of the ginning process.

The cotton ginning process creates 2.5 million tons of biomass each year; spray mulches turn this waste into a practical product that benefits the environment. The deep green hydromulches are hydraulically applied. And since cotton is by nature porous, absorbent and biodegradable, it absorbs adequate amounts of moisture and provides that moisture to vegetation so that it can establish quickly, and erosion from heavy wind and rain is controlled.

Cotton Incorporated collaborated with the USDA's ARS and Mulch & Seed Innovations of Centre, AL, to develop two all-natural cotton-fiber mulch products that help control soil erosion until grass or other vegetation can take root. The GeoSkin™ cotton hydromulch is ideal for level construction zones, while HydraCX2® is optimal for steep roadside projects.

The ARS tested the cotton hydromulches against commercial erosion control blankets made of wood, paper and synthetics. The results showed the cotton products performed better in preventing runoff and required significantly less labor.

Both products are marketed with the highly recognized Seal of Cotton and have effectively established other revenue sources for cotton.

Biodegradable Packing Material

Cotton Incorporated also collaborated with Ecovative Design, a sustainable material science company, to create Mushroom® Materials—naturally grown, 100% biodegradable packaging made from cotton by-products. The high-performance packaging can be molded like synthetic foam and is cost competitive and environmentally responsible since it can be composted after usage.

Ecovative produces two packaging materials, Myco Foam and Myco Board. Their low-energy manufacturing process starts with agricultural waste, including cotton burrs, from crop production. This substrate is cleaned and combined with a mushroom component called mycelium, which is the fine white filament produced during the vegetative growth stage of fungi.

The mycelium strands intertwine and reach out toward the substrates. They break down the tough compounds and form a matrix. Ecovative refers to this as a mushroom material. That material is broken up then packed and sealed into molds, in which the material takes on their form.

It is currently being used by a number of companies, from Dell, for their sensitive hard drives, to Puma, for their limited edition stand-up paddle boards. Ecovative recently partnered with Sealed Air Corp., a global packaging solutions leader, to bring the product to customers around the world.

Sustainable Wall Covering

Just as cotton has the ability to absorb water, so too can it absorb heat and sound, which made it the ideal main component in the sustainable wall finish from JaDecor Natural Wallcovering.

The JaDecor product is used in both residential and commercial applications for its ability to decrease everyday noises, such as those from planes or barking dogs, as well as its capacity to promote fuller sound in concert halls.

When Chicago-based testing facility Riverbank Acoustical Laboratories tested JaDecor's sound absorbency properties using the reverberation room method, it was assigned an impressive 0.15 noise reduction coefficient (NRC).

JaDecor also works as a thermal insulation, providing warmth to interior spaces. The product is made from a mixture of natural cotton fibers and minerals. It is not sold at retail and must be hand-troweled onto walls by a certified installer.

JaDecor is environmentally safe and has a low carbon footprint since it is sourced from U.S. cotton.

The company is also

EXPLORING USES FOR THE ENTIRE COTTON PLANT

in commercially viable, if unexpected, products.

Current uses for cottonseed include

A SUPPLEMENT FOR DAIRY CATTLE FEED AND COOKING OIL.

COTTONSEED

Although cotton is considered first and foremost a fiber crop, it is regulated as a food crop by the Food and Drug Administration because its by-products, including cottonseed oil, have long been used in kitchens, the commercial food industry, cosmetics and medical applications. Recently, long-term research supported by Cotton Incorporated has paved the way for an expanded use of cottonseed as a foodstuff.

Cottonseed has been pressed for its edible oil for more than 100 years. Wesson pressed deodorized cottonseed for cooking oil. And in the early 1900s, Proctor & Gamble used hydrogenated cottonseed oil—crystallized cotton—to make Crisco® vegetable shortening. It continues to be used as neutral-flavored cooking oil, one with a high smoke point that will not burn or scorch in the pan.

While Crisco® has since changed its formula, cottonseed oil continues to be used in a variety of prepared foods. It is shelf stable and has low levels of saturated fats, with no trans-fats or cholesterol and is not partially hydrogenated. These properties have boosted its use as an ingredient in foods, such as cereals, breads and snacks. U.S. consumption is about three pints per capita.

Though it has not historically been a direct food source for humans, cottonseed has enjoyed success as a dairy feed supplement. Cotton Incorporated worked with growers to develop prepared cottonseed for the feed market, primarily for cows, which are ruminant animals whose stomachs can digest the seed. The result was "seed as feed." Sold to dairy farmers in pellet form and blocks of feed supplement, they provided a new line of revenue for cotton growers.

But the cottonseed itself has never before been used as a human food source because the seed contains a natural pest deterrent called gossypol, beneficial because it works to keep insects and pests away from the plant but toxic in high doses to humans and other animals. This was a challenge given cottonseed's very healthful profile: trans-fat free, gluten free, and 23% protein.

One estimate suggests the U.S. industry is six to 10 years away from planting a million acres of ultra-low-gossypol biotech cotton.

AS A MEANS TO ADDRESS HUNGER IN DEVELOPING NATIONS, THE POTENTIAL FOR ULTRA-LOW GOSSYPOL COTTONSEED IS ENORMOUS.

In the 1950s, researchers discovered a gossypol-free cotton strain. Scientists bred the trait into traditional cotton varieties, and studies confirmed that the cottonseed meal from the seed was safe for human consumption. Unfortunately, without the gossypol, the cotton plants became a veritable feast for pests and insects. Consequently, researchers went back to the drawing board and considered bioengineering a plant that could fend off the pests while still producing edible seed.

Since the 1990s, Cotton Incorporated has helped fund genetic research at Texas A&M University. Scientists there have successfully silenced the gene that produces gossypol in certain parts of the plant. The result is a new ultra-low gossypol plant that contains gossypol only in the stem and leaf of the plant, while leaving only ultra-low (and digestible) levels of gossypol in the seed.

Today, 20 million cotton farmers produce 44 million metric tons of cottonseed—the equivalent of 10 million tons of protein. Essentially, the protein requirements of 500 million people could be met by using edible cottonseed.

Regulatory approvals will take time, but one estimate suggests the U.S. industry is six to 10 years away from planting a million acres (more than 400,000 hectares) of ultra-low-gossypol biotech cotton. As a means to address hunger in developing nations, the potential for ultra-low gossypol cottonseed is enormous.

Cotton Incorporated also sponsors an interdisciplinary cottonseed research project at New Mexico State University. The school began growing glandless cotton (gossypol is only produced by tiny glands in the cottonseed) two years ago and has been testing it in field and lab trials, which include agronomic and insect resistance evaluation. NMSU grows and harvests test crops of glandless cotton and then presses the cottonseed for cooking oil for use on campus. And their pilot program involves milling glandless cottonseed down for use as a wheat flour substitute in baked goods such as cookies and cakes.

NMSU has also created a potentially lucrative new market for ultra-low gossypol cottonseed by using ground meal for shrimp feed. The cottonseed is ground into a fine consistency and mixed with algae. As part of NMSU's aquaculture program, this meal is turned into a pellet and fed to farm-raised shrimp.

Shrimp are typically fed meal made from processed fish. But with overfishing being a problem in today's world, cottonseed provides an alternative to the protein found in fish feed.

Today, 20 million

COTTON FARMERS PRODUCE 44 MILLION METRIC TONS OF COTTONSEED.

In two mill audits, Cotton Incorporated identified

POTENTIAL SAVINGS OF MORE THAN $6 MILLION.

MANUFACTURING

It is no longer enough for textile innovations to focus solely on interesting fabric features. The industry is evolving with an eye toward high-performance fabrics produced with sustainable, low-impact methods.

To that end, Cotton Incorporated has demonstrated its commitment to eco-conscious production by working with industry leaders to bring new products and processes to their businesses.

For example, the company collaborated with DuPont on a product that makes the preparation and dyeing processes more eco-friendly. DuPont's PrimaGreen® products offer an effective alternative to the chemicals typically used. The PrimaGreen® product calls for the enzymes for scouring, bleaching and dyeing to be combined, which consolidates some steps in the process without sacrificing quality. The bioenzyme combination allows the same water bath to be used for multiple steps in the dyeing process. The products perform at a lower temperature, allowing processors to use less energy for heat. On average, water usage was reduced by 70%, steam by 33% and energy by 27%. Such efficiency reduces total costs of these inputs by an average of 66%. Since the PrimaGreen® products consolidate steps, they save overall processing time and speed products to market.

Trials performed by Cotton Incorporated and DuPont ultimately showed the bio-based enzymes combine to eliminate the need for caustic chemicals while dramatically reducing water consumption.

WATER, ENERGY AND CHEMICALS

Just as Cotton Incorporated is dedicated to increasing sustainability for growers, it is also committed to supporting businesses that transform cotton into consumer products in their efforts to reduce their environmental impacts.

To that end, the company has created a guide titled *World of Ideas*, which focuses on identifying and promoting strategies to reduce water, energy and chemical (WEC) usage in textile processing. To create the how-to booklet, Cotton Incorporated surveyed 40 cotton textile processing companies in areas of China, India, Turkey, Southeast Asia and the Americas. The companies shared what became 26 practical and effective changes made to their processes, dyes and chemicals, equipment, control systems and management and wastewater treatment that significantly reduce WEC requirements.

The guide details how the WEC environmental footprint can be cut in half by modern textile plants in the world's major textile regions, further laying the groundwork for future sustainable improvements.

SUSTAINABLE WATER PRACTICES

For some time, water conservation has been top of mind for Cotton Incorporated, inspiring even further innovation and creativity in a desire to find solutions. In factories and, labs, the search is ongoing to create cotton textiles while using less water.

Cotton is a remarkably drought-tolerant plant, and two-thirds of the U.S. crop is grown with natural rainwater. Despite its hardiness, cotton requires water, whether in the form of rain or irrigation, at key stages of the growth cycle. If, for instance, there is inadequate rainfall after sowing and fertilizing, the crop may be compromised, and valuable land, time and inputs could be lost.

Since water is such a precious resource for the 17 U.S. states that grow cotton, growers are now relying on precision agriculture techniques, which DELIVER WATER ONLY WHEN AND WHERE IT IS NEEDED.

However, experts say the century of "the golden age of water"—during which water was unlimited, safe and free—is ending for the developed world. Drying lake beds and riverbeds around the globe are proof that water supplies are changing.

To identify the most effective way to grow and process cotton with the least amount of water, Cotton Incorporated has been working with cotton producers and scientists. This work will help growers save both money and water and will prepare them for the possibility of increased regulations on water use.

In the field, improvements in agriculture have produced some of the biggest reductions in water usage.

Since water is such a precious resource for the 17 U.S. states that grow cotton, growers are now relying on precision agriculture techniques, which deliver water only when and where it is needed. This technology is more efficient than improperly applied flood irrigation or using low-efficiency sprinkler systems that may waste water because of wind drift or evaporation.

Researchers have discovered that plants do best and water is used most efficiently when it is delivered close to the plants, very low to the ground and directly into the soil. One such method calls for drop lines to be hung from traditional sprinkler systems so growers can "lay" the water down between rows.

Subsurface drip irrigation is another growing trend. Although the tubes, which are set between six and 18 inches below the surface of the entire field, are expensive to install, they ensure water is delivered right to the plant roots. A more recent innovation is toward shallow subsurface drip systems. Buried in just two-to-four inches of soil, these systems reduce damage from insects and rodents.

Other irrigation approaches are even more innovative. Growers can use computer models that predict water use based on the growth state of the plant and weather data, as well as thermal infrared thermometers that measure leaf temperature, which rises as the plant's need for water increases.

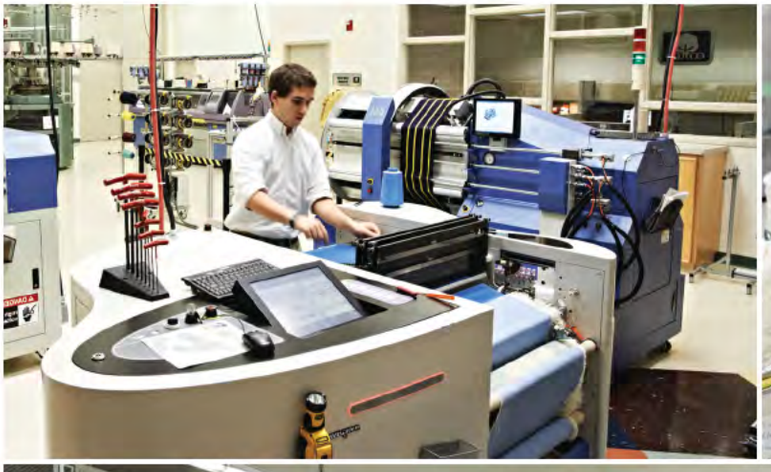
In the lab, scientists are striving to use advances in biotechnology to increase cotton's drought tolerance. Such research will prove valuable not only to cotton producers but also to those growing other crops around the world.

CONSERVATION AT THE MANUFACTURING LEVEL

Conservation of all types—water, energy, chemical and more—is also happening at the manufacturing level. The Technical Services & Implementation (TSI) department, part of the Cotton Incorporated Product Development & Implementation division, has helped mills and manufacturers optimize efficiencies within their operations. In 2012, TSI undertook a major project focusing on environmentally friendly manufacturing processes. In two mill audits, Cotton Incorporated identified potential savings of more than $6 million.

In another initiative in Hong Kong, Cotton Incorporated collaborated with a denim manufacturer to fund the installation of vibrating membrane technology for recycling dye and water from dyeing. The process removes indigo from the water after the denim fabric has been dyed. The indigo dyestuff and water are separated from the dye house waste stream so both can be reused multiple times in the company's denim processing. The most recent data show 70% of the water, or about 20,000 gallons a day, and 100% of the indigo can be reutilized.

In addition to investigating methods for reusing indigo, the Cotton Incorporated Technical Chemistry Research department, also part of the PDI division, is exploring other sustainability measures, such as sulfur dye alternatives to indigo.



The Technical Services & Implementation (TSI) department, part of the Cotton Incorporated Product Development & Implementation division,

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82%

of consumers prefer their clothing to be made of cotton and cotton blends.

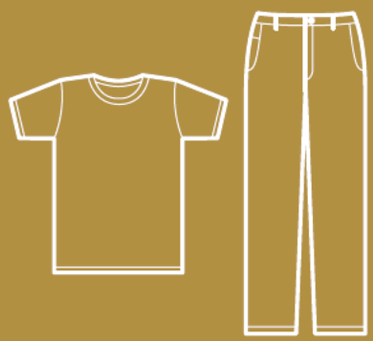
91%

of consumers say cotton is safe for the environment.

78%

of consumers say "100% cotton" claims are influential to their apparel purchases.

THE CONSUMER



Cotton Incorporated extends its environmental commitment to the consumer in two ways: through consumer engagement in the Blue Jeans Go Green™ denim recycling program and through a range of market research that collects consumer attitudinal information on environmental issues, and explores means of "sustaining" consumer interest in cotton and cotton apparel.

The Blue Jeans Go Green™ program began in 2006 as the Cotton. From Blue to Green.™ denim drive, which took place across 14 U.S. colleges and universities and during which 14,566 pieces of denim were collected. A year later, 70,000 square feet of UltraTouch™ Denim Insulation was manufactured from the collected denim and donated to a Habitat for Humanity project in New Orleans.

Over time, the program has evolved to include corporate sustainability initiatives and retail partners, which have proved effective means to provide consumers with a discount on new apparel items in exchange for donating unwanted jeans. Since its inception, the program, now renamed Blue Jeans Go Green™, has collected more than one million pieces of denim, diverted more than 600 tons of denim from landfills, and aided numerous communities in need.

On the market research side, Cotton Incorporated analyses encompass consumer attitudinal and behavioral research. These help sustain the viability of cotton in the marketplace by identifying desirable attributes and performance features that resonate with consumers.

The Cotton Incorporated *Lifestyle Monitor*™ Survey has tracked consumer behavior and preferences since 1994. Topics include apparel, the environment, shopping, the economy, fashion, fiber selection and more. Each month, Bellomy Research completes more than 500 interviews with U.S. consumers between the ages of 13 and 70. More than 80,000 interviews have been completed since the survey's inception, revealing a long-standing preference for cotton.

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TO ENABLE COTTON TO BETTER COMPETE WITH SYNTHETICS, COTTON INCORPORATED WORKED TO DEVELOP TEXTILE INNOVATIONS

for specialized cotton fabrics that have water-wicking, quick-drying and waterproofing capabilities.

Indeed, *Monitor* data indicate cotton is the fiber of choice among most consumers, with more than eight out of 10 (82%) saying they prefer their clothing to be made of cotton and cotton blends and more than nine in 10 (91%) saying cotton is safe for the environment.

Cotton Incorporated research also reveals that cotton is an influential marketing tool. Nearly eight out of 10 consumers (78%) say "100% cotton" claims are influential to their apparel purchases, the Cotton Incorporated 2013 Environment Survey shows, followed by "natural" (60%), "sustainable" (57%), "environmentally friendly" (53%), and "green" (48%).

Research efforts such as these indicate long-term consumer attitudes and preferences, which can then inform decisions across the supply chain.

One such example is in technological innovation, spurred by research indicating a strong consumer preference for cotton in athletic apparel, but few options were available at retail. Cotton Incorporated worked to develop textile innovations for specialized cotton fabrics that have water-wicking, quick-drying and waterproofing capabilities, enabling cotton to better compete with synthetics.

Some of those innovations include:

- Wicking Windows™ technology, which pulls moisture from the skin and forces it to the outside of the fabric, where it can evaporate
- TransDRY® finish, which wicks and spreads perspiration for fast-drying performance
- STORM COTTON™ technology, a water-repellent finish for cotton that protects the wearer from rain and snow while allowing the fabric to breathe
- STORM DENIM™ finish, a water-repellent technology for cotton denim that does not inhibit denim's natural ability to breathe, yet lasts for the life of the garment

These new technologies have allowed cotton to regain market share from man-made fibers in the activewear and outdoor apparel markets. The company's Wicking Windows™ and TransDRY® technologies have attracted major brand partners in athletic apparel, while the STORM COTTON™ and STORM DENIM™ finishes appeal to manufacturers of outdoor apparel, workwear and even mainstream denim makers.

Cotton Incorporated is not only interested in consumers' attitudes toward new apparel purchases but also in the life of that new garment itself. In completing the Life Cycle Inventory & Life Cycle Assessment of Cotton Fiber & Fabric, the company found that the consumer-use phase of a garment provided the strongest opportunity for significant environmental gains. As a result, Cotton Incorporated has directed resources toward educating consumers on sustainable garment care.

SUSTAINABILITY COMMUNITY

To meet the challenge of creating a sustainable textile industry, Cotton Incorporated often partners with other organizations. These partnerships mark an opportunity to collaborate on research, as well as to share the company's expertise on cotton and sustainability methodologies. Some of these organizations include:

- The Sustainability Consortium is an independent group of businesses, universities and nongovernmental organizations working to develop science-based tools to measure the sustainability of consumer products.

- The Sustainable Apparel Coalition is an industry-wide group of more than 100 leading apparel and footwear brands, retailers, suppliers, nonprofits and nongovernmental organizations working to reduce the environmental and social impacts of apparel and footwear products around the world.

- The Better Cotton Initiative works to promote measurable and continuing improvements for the environment, farming communities and economies of cotton-producing areas. The initiative aims to transform cotton production worldwide by developing Better Cotton as a sustainable mainstream commodity.

- Field to Market: The Alliance for Sustainable Agriculture is an independent organization working to foster continual environmental improvements in U.S. row crop agriculture while maintaining productivity and farmers' economic well-being.

- Cotton LEADS™: Building upon years of research and outreach that have contributed to the environmental gains of U.S. cotton growers, Cotton Incorporated joined National Cotton Council, Cotton Council International and the Australian cotton industry to launch the Cotton LEADS™ program in 2013. The goal of the Cotton LEADS™ program is to elevate awareness of the responsible and transparent growing practices employed by U.S. and Australian growers to global brands, retailers, and manufacturers. The international alliance exemplifies Cotton Incorporated's historic role as a catalyst for environmental milestones within the U.S cotton industry, and solidifies the company's ongoing commitment to fostering positive change for the worldwide cotton industry.

Since Cotton Incorporated's formation, the cotton industry has made significant strides in sustainability. One of the company's landmark efforts was its support in conducting the comprehensive Life Cycle Inventory & Life Cycle Assessment (LCI and LCA) of Cotton Fiber & Fabric.

Prior to the LCA, the industry did not have a cradle-to-grave measurement of the potential environmental impact of cotton fiber production, textile manufacturing or consumer use. Any information that was available was often obsolete or based on supposition.

So in 2009, Cotton Incorporated, with support from the Cotton Foundation, the National Cotton Council, Cotton Council International, and PE International, began the process of undertaking a study that would enable businesses to make better sourcing decisions. The key was to establish current and accurate benchmarks of potential environmental impacts across the global cotton supply chain, to a degree that no other fiber had previously completed.

The LCI collected detailed data regarding cotton fiber production, the textile manufacturing process, transportation, garment creation, consumer use and, finally, end of life. The cotton-centric LCA, which does not compare itself to other fibers, helped identify areas for improvement and will serve as a benchmark to measure progress moving forward.

The LCA project is global in scope, with averages based on information available for major cotton-growing regions, such as the United States, China and India.

At the completion of the project, Cotton Incorporated shared the peer-reviewed data with the sustainability community to help decision makers throughout the apparel industry achieve their sustainability goals.

COTTON INCORPORATED

PIONEERS OF PROGRESS

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