REPORT OF COTTON INCORPORATED
TO THE SECRETARY'S OFFICE

Year-End 2018
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OVERVIEW OF CONTENTS

Each year Cotton Incorporated prepares a formal Strategic Plan* that covers the key principles that guide the Company’s long-range activities. The major priority areas over the next five years for programs at Cotton Incorporated are:

- Two long-term goals
  - 20 million bales of U.S. cotton production by 2026
  - 130 million bales of global cotton demand by 2026
- Stabilizing and regaining market share
- Address rising cost of production
- Increasing sustainability efforts
- Facilitate new technical innovations to improve cotton products
- Create demand for cotton to increase exports of U.S. cotton
- Continue to emphasize cotton’s benefits through television advertising, digital, and social media channels

In order to fulfill these priorities, specific strategic objectives are outlined for each of Cotton Incorporated’s four Operating Committees and related subdivisions:

- **Agricultural Research Committee**
- **Research and Development Committee**
  - Fiber Competition: *Fiber Quality*
  - Fiber Competition: *Cotton Management System (EFS)*
  - Product Development and Implementation (PDI)
- **Global Supply Chain Marketing Committee**
- **Consumer Marketing Committee**
  - Advertising, Public Relations, and Strategic Alliances
  - Corporate Strategy and Program Metrics (CSPM)

Operating Committees determine tactics and activities to meet the strategic objectives identified for their program area or divisions within their program area and provide deliverables of their activity to the Board.

This bi-annual report includes the following sections:

1. **Executive Summary**: Overview of year-to-date progress report toward achieving Cotton Incorporated’s mission and strategic objectives, organized by program committee and its related divisions.
2. **Report of Activities by Program Committee and Strategic Objectives**: Detail of year-to-date progress report toward achieving Cotton Incorporated’s mission and strategic objectives, organized by Program Committee and its related divisions.
3. **Explanation of Terms and Activities**: Summary descriptions of ongoing projects and key terminology used to explain activities within each Program Committee and its divisions are included as a reference guide

*Please refer to page 1 of the 2018 Plan & Proposed Budget Book for complete details on Cotton Incorporated’s current strategic plan.*
EXECUTIVE SUMMARY

This Executive Summary section provides an overview of the report from each of Cotton Incorporated’s four operating committees and related subdivisions.

Agricultural Research Committee

Agricultural & Environmental Research (AERD)

By mid-season of 2018 it was apparent that serious challenges were already “baked into” the U.S. cotton crop with new pathogens, expanded resistant weeds, and severe drought. Growers and researchers, however, could not imagine the unprecedented harvest challenges ahead. Due to frequent rains, many growers will harvest some or all of their 2018 cotton in 2019 and face substantial reductions in quality. In the wake of a year that presented tremendous challenges to cotton growers, there were also great successes in research and outreach, and the Agricultural and Environmental Research Department (AERD) continues to support greater resiliency in cotton production.

Several AERD successes in 2018 bear highlighting. To address challenges of diseases and nematodes with cooperators AERD: 1) identified Upland varieties with tolerance to Fusarium Wilt race 4 and released a comprehensive management bulletin for Southwest growers, 2) delivered a detection method for Bacterial Blight in planting seed, 3) responded to a novel virus that spread across the Mid-South and Southeast U.S. with detection methods and redirection of plant virologists and pathologists, and 4) evaluated commercial varieties with the Barbre reniform host plant resistance trait. To enhance the value of cottonseed, USDA-APHIS deregulation of Ultra Low Gossypol Cottonseed was obtained, and AERD completed and published a three-year, human feeding study demonstrating the health benefits of cottonseed oil consumption. Further, the Whole Cottonseed marketing program was upgraded with a new advertisement and trade show booth. To enhance fiber quality, a robot harvesting initiative was launched that demonstrated substantial yield and quality improvements. Novel contamination detection and removal equipment was installed in commercial gins, and open source software was developed to trace cotton from the field to the gin. In the area of agronomy, precise guidelines were established for pigweed seed survival and resistance extent in the Southwest, a novel herbicide mode of action was field tested and guidelines for soil health in limited rainfall conditions were released. In the area of entomology, improved IPM guidelines were released for bollworms and tarnished plant bugs. In the area of variety improvement, gene editing in cotton was demonstrated and targets for disease control and fiber quality were identified. Reference grade genomes for all five tetraploid cottons were sequenced and assembled, as well as high yielding commercial germplasm for public sector breeding, and the Cotton Winter Nursery in Costa Rica was again successful.

Research and Development Committee

Fiber Competition: Fiber Quality

Quality Research consisted of nine outside research projects for 2018 with a renewal of six projects and the initiation of three new projects. The majority of projects in 2018 were focused on the Fiber of the Future effort which involves improving fiber length uniformity and the second priority was contamination detection at the gin. The third priority was given to completing the work involving the calibration of high volume instruments (HVI®) for fiber elongation. Lastly, work was continued in the development of reference materials for fiber maturity standards.

Product Evaluation Laboratory (PEL) activities continued to focus on day-to-day testing. Multiple fiber proficiency studies were run, and the lab also provided testing for the USDA-AMS on nine sets of calibration cottons using both HVI® models. A total of nine proficiency tests for fabric were also completed this year as well as one yarn proficiency test. Testing services were active for all areas of research and implementation for both Agricultural & Environmental Research and Product Development & Implementation divisions. The lab also completed the installation, conversion, and training for a new version of LogBook® software, a specialized system used by the PEL for all data collection and reporting. This next generation of LogBook® software was created using developer tools that are readily available and forward compatible with future generations of Windows® which will keep the ‘paperless’ lab moving forward smoothly.
The contents of this report provide a review of the Cotton Management System (CMS) activities and initiatives for 2018. These activities chart the progress toward two strategic objectives:

- Develop and maintain software tools to buy, sell, move, and use cotton with improved efficiency and profitability.
- Service and market CMS products that promote cotton as the most efficient and profitable fiber in the marketplace.

The CMS Product Development team continues to support MILLNet™ software products, with the primary focus on updates and enhancements for version 5.0. The MILLNet™ 5.0 software is being used for all new licensee installations, and conversions of existing users are still ongoing. A primary focus for conversions in 2018 was to complete as many of the U.S. mills as possible, and all but three U.S. licensees were completed. Global conversions were also started in 2018 with one completed in Vietnam and two completed in Mexico.

The CMS Technical Service and Marketing teams assisted customers 3,429 times by phone, e-mail, text, face-to-face, and the Internet. Routine service visits were conducted in China, Colombia, El Salvador, Guatemala, Mexico, Nicaragua, Peru, Philippines, Thailand, U.S., and Vietnam. Marketing visits were made to prospective mills in Costa Rica, El Salvador, Guatemala, Indonesia, Mexico, Peru, Thailand, and Vietnam. Seven new MILLNet™ software licenses were signed, and all new installations were completed in 2018.

For reference and a better understanding of some of the terms used throughout this report, a glossary is included.

Product Development and Implementation (PDI)

“Performance Cotton” remains an important initiative for the division and is being addressed through yarn, fabric constructions, and finish developments. Innovative fiber blend developments to introduce more cotton into synthetic markets continues. In addition, engineering yarn with lower twist levels addresses the need for softer, more drapable fabrics. Both knit and woven fabric developments, focusing on the active market, continues. The release of the FABRICAST™ 2018-1 collection featured 66 new knit and woven fabric developments for the apparel and home markets with a special emphasis on raised surface constructions to compete with synthetic “Polar Fleece” type constructions. Progress was also made to quick-dry cotton solutions such as the SportDRY™ finish a sweat hiding technology, and cotton/polypropylene blend developments. Hundreds of outside research proposals were reviewed and 20 were chosen for further consideration in 2019. Work incorporating cotton into wearable electronics and 3D printing filaments continued as well.

Sustainability is a key priority, complementing PDI’s initiative in performance cotton. Phase one, of the microfiber research, Aquatic Degradation of Cotton Research, was completed and has progressed into the next stage. The non-formaldehyde technology was formulated into a flame retardant technology, supporting new raised-surface fabric developments in the FABRICAST™ collection. Fabrics such as cotton and wool blends were also developed as natural alternatives for synthetic fleece. A minimally processed collection of fabrics were developed to extend the natural theme of cotton. CO2 waterless dyeing of 100% cotton fabric was scaled up to treat a pilot amount of fabrics. A bench top experiment of cotton to sugar is ongoing with the goal to utilize end of life cotton textiles as a biomass for glucose generation and conversion of glucose into new value added products.

The latest airjet spinning technology, a Murata Vortex Spinning (MVS) 870 system, was recently installed in the Fiber Processing Lab (FPL) at no cost to Cotton Incorporated. Fiber Processing has started to evaluate this new technology. A feasibility study is being conducted in FP using ultra-low micronaire to research best processing methods and end-product uses. Fiber Processing also did a breeder study to evaluate two new cotton fiber varieties with a major seed company. Joint research on a non-formaldehyde, durable press technology continued in 2018. Successful trials have led to a full hand-off to the Technical Service and Implementation (TSI) team to implement into the industry. Implementation and support of TOUGH COTTON™ technology has remained strong with more brands running trials. New major brands have adopted STORM COTTON™ technology.

The PDI division maintained industry connectivity through trade shows, conferences, company visits, research trips, and lab tours. Use and availability of the 2015 cotton life cycle assessment data continues to spread. The consumer impact of laundering, based on results from the LCA, was presented at an international conference event. Product Integrity led the SAC
Material Sustainability Index task team to refine a taxonomy. A proposal for the qualitative assessment of chemistry in the Higg product tool was developed. A long-term strategy for the quantitative assessment of chemistry is now being considered.

**Global Supply Chain Marketing Committee**

Global Supply Chain Marketing (GSCM)

During the second half of 2018, GSCM staff conducted more than 530 meetings with companies in both the manufacturing supply chain and with key brand and retailer accounts. GSCM staff focus efforts on influencing major brands and retailer through coordination of various Company resources, with the goal of influencing the use of cotton versus other fibers. Staff participated in several major tradeshows in the second half of the year. In both July and November, staff participated in the Outdoor Retailer Show in Denver, CO. This tradeshow is the largest U.S. tradeshow and premier business event for the outdoor industry. Staff attended The Functional Fabric Fair by Performance Days July 24, 2018. This was the first show for The Functional Fabric Fair in NY and was located at the Javits Center. Mexico City staff was very active during the second half of 2108 either hosting, sponsoring, exhibiting, or attending several industry events. The fifth edition of the Latin American Retailers’ Workshop was hosted in Mexico City, with the aim to educate 65 apparel buyers on cotton products and processing. Cotton Incorporated staff organized a one-day event in Shenzhen, China that hosted more than 80 representatives from leading Chinese manufacturers and apparel brands/retailers.

In its fifth full year, the Cotton LEADS℠ program continues to gain momentum as a platform for communicating information about responsible U.S. cotton production to retailers, brands, manufacturers, and industry organizations worldwide. Cotton Incorporated participates in this program with the National Cotton Council of America, the Cotton Foundation, Cotton Australia, and Cotton Council International. In 2018, 57 new partners joined the program, thus reaching a total of 560 partnering manufacturers, brands, and retailers.

The GSCM division is responsible for all messaging to the trade. In 2018, consistent messaging and imagery was implemented throughout, including tradeshows, tradeshow promotional items and outlets, and other publications. In addition, new messaging was created for 2018 placement to highlight cotton solutions to the microfiber issue. Trade advertisements were placed in industry publications during the second half of 2018.

In the second half of 2018, the GSCM division continued the focus on marketing the natural story of cotton and the focus on sustainability in the industry. This information was very timely in response to the issues surrounding micro plastic pollution in oceans and waterways and how supply chain partners are seeking opportunities to reduce their pollution in all environments from raw materials to ways the raw materials or fabric are processed. This natural cotton story was conveyed and displayed at tradeshows, in printed brochures, online, in trade advertisements, and on the CottonWorks™ website. Many brands and retailers have increased interest in this natural and environmental story, with a focus on sustainability.

Several brands and retailers who have adopted cotton technologies have continued those programs in 2018. One of the largest programs has come from multiple retailers using the TOUGH COTTON™ technology on cotton knits and wovens to increase abrasion-resistance and wear life in their end products. Three large outdoor and lifestyle brands are continuing their STORM COTTON™ technology programs and expanding by introducing new colorways and updated styling. A large denim brand is continuing their TransDRY™ technology program for the second year and volume has nearly doubled since the launch. One outdoor/lifestyle brand is continuing their TransDRY™ technology program in men’s and women’s products for the third year with updated styles and fabrications each season.

In the fall, a major global consumer brand whose largest business is in baby care launched a new line of baby shampoo/wash and lotion, containing tiny particles of cotton. Their TV and online advertising features the value of cotton to the products’ performance. The cotton enhanced™ trademark has a key presence in all their marketing communications, consumer, retail, and institutional. The company’s goal is to be the number one choice for consumers and hospitals for newborns. The U.S., Canada, and India were target countries for 2018. In 2019, product launches are planned for Brazil, U.K., China, Indonesia, Australia, and New Zealand. Social media support was provided in 2018.
The CottonWorks™ platform, previously COTTON UNIVERSITY™, is the main marketing platform of the Global Supply Chain Division and is supported by the ISP program. The CottonWorks™ platform includes technical education workshops, webinars, education for emerging professionals, events such as the farm tours, and numerous other activities to increase the use of cotton in products. Twenty-two technical education workshops were held in the second half of 2018 with over 800 attendees. These individuals were from major brands and retailers. In the second half of 2018, two webinars were held, bringing the total to five webinars in 2018. Topics this year included biodegradability in soil environments, biodegradability in wastewater environments (a combination of these two topics were translated for Spanish-speaking audiences), advances in sustainable dyeing, and sustainable denim finishing. Webinars reached more than 830 unique participants from 377 different organizations.

Consumer Marketing Committee

Advertising

The second half of 2018 saw the continuation of the consumer advertising campaign, “Life is Uncomfortable.” The 360° campaign reached consumers through TV, Cotton’s consumer website, TheFabricOfOurLives.com, digital media, including social and paid search and point of purchase.

In the fourth quarter, the “Life is Uncomfortable" campaign delivered strong recognition, with consideration and emotional connection to cotton being higher among those who recalled seeing “Tattoo" or “First Day” on television. Those who had previously seen at least one of the ads also checked labels for fabric content more frequently. Top-of-mind awareness significantly increased, reaching a historic high. The most common outcomes consumers cited after viewing the campaign videos included preferring cotton over other fabrics, wishing they had more cotton clothes, and realizing cotton is fashionable.

A total of 1,290 television exposures appeared across ABC, The CW, and FOX broadcast networks and 11 cable channels. Programming targeted women and men 18-49 and included shows such as Empire, The Good Doctor, and Riverdale. Online, the “Life is Uncomfortable” videos garnered 80M video views on fashion, lifestyle, and health/wellness sites. In addition, the campaign drove traffic to TheFabricOfOurLives.com, where users could learn more and shop cotton-rich items.

In 2018, the Advertising department attended over 25 industry events, webinars, workshops and conferences to stay abreast of the ever-changing brand and media landscape. Events like South by Southwest, ANA Webinar: Driving Profit through Gen Z & Millennial Cultural Trends, IAB Direct to Consumer Brands Summit and Social Media Week helped keep the staff informed to strategically position cotton in the marketplace.

Public Relations

Notable among the Public Relations Department accomplishments for the second half of 2018 were activities in support of the sustainability of U.S. cotton; cotton and activewear; cotton’s connection to human health and hygiene; and consumer-facing corporate initiatives such as the Blue Jeans Go Green™ denim recycling program. Expanded synopses of these activities are below.

During the third and fourth quarters of 2018, the department secured coverage in atypical and desirable media outlets. Some were a result of an external agency, which provides support for consumer-facing media coverage of cotton and Cotton Incorporated, and some were achieved independently by the Public Relations Department. Among these were news items in The Chicago Tribune, The Triad Business Journal, today.com, and NPR.

Strategic Alliances

The Strategic Alliances Department focused on the action phase of the Consumer Marketing business model during the second half of 2018 through partnerships with retailers such as Amazon, goop, and Buckle. The department worked with these retailers to curate engaging and shoppable cotton collections with a reach of over 400M consumers exposed to cotton messaging at the point of purchase. Through the Blue Jeans Go Green™ (BJGG) program this year, more than 386,000 pieces of denim were collected for recycling, resulting in over 193 tons of textile waste being diverted from landfills. In addition
to continued ongoing partnerships with Madewell and J. Crew, Strategic Alliances increased its’ audience within the college sector securing six new colleges who participated in the BJGG program – a 100% increase compared to last year.

Corporate Strategy & Program Metrics (CSPM)

During the second half of 2018, the Corporate Strategy & Program Metrics Department (CSPM) continued to identify opportunities and threats for cotton using market intelligence gathered through ongoing studies of consumer attitudes from the Lifestyle Monitor™ survey, assessments of cotton’s share at retail through the Retail Monitor™ research, and comprehensive global market and economic research and analysis. In total, CSPM provided 92 information requests; participated in over 80 meetings and presentations; authored 126 publications, videos, TV/radio segments, and podcasts; and worked on 15 projects.

Work completed by CSPM during the third and fourth quarters of 2018 includes, but is not limited to the collection and examination of data on more than 80K products offered at retail in the U.S. and India; the evaluation of over 25K consumers (two-thirds global consumers and one-third U.S.); the update of a comprehensive database of monthly apparel and home furnishing imports; the management and analysis of global quantitative research in China; the management of Cotton Incorporated’s brand tracking metrics; and the delivery of consumer and economic outlook presentations. Descriptions of major projects in each area during the second half of 2018 are provided below.
AGRICULTURAL RESEARCH COMMITTEE

AGRICULTURAL AND ENVIRONMENTAL RESEARCH

Strategic Objective 1: Increase the short-term profitability of U.S. cotton production.

Cottonseed
The large 2017 cottonseed crop exceeded the capacity of the dairy industry to consume ever-increasing supplies of cottonseed during 2018, without a reduction in price. Oil mills are running at full capacity with the ability to process about two million tons (about 30% of the crop). The low price of cottonseed in 2018 increased the focus on activities that could potentially increase the value of cottonseed. Marketing activities were put in place to strengthen and expand the cottonseed market efforts in 2018. The website, www.wholecottonseed.com, was refreshed, updated, and converted into a mobile-friendly design. New content for both digital and print advertising campaigns were created and placed in the relevant dairy and feed media. Radio advertising was expanded on a syndicated broadcast that focuses on dairy industry issues and news. The cottonseed trade show booth and corresponding collateral marketing materials were updated prior to the World Dairy Expo in October. The new booth design won an award for “Best Booth” and generated renewed interest in feeding cottonseed. The traffic through the booth was steady and there was tremendous interest among dairy producers to reintroduce cottonseed to their feed rations, especially now that it is more cost competitive with other feed ingredients. Several press releases during the year featuring the status of the 2018 crop and encouraging users to increase usage of cottonseed were distributed and widely published in dairy and feed media.

A comprehensive new strategy for cottonseed oil marketing was developed, from new marketing materials to collateral. Two meetings with the oil mill industry were conducted to set the direction, focus, and activities of this marketing effort. The process of transferring the cottonseed marketing program from the Agricultural and Environmental Research Department to the Consumer Marketing Department was completed.

Precision Cotton
Efforts continued in 2018 to enable more U.S. cotton producers and ginners to benefit from the Radio Frequency Identification (RFID) codes now standard on John Deere modules (that can be added to any cotton module). In 2017, an Android application called Cotton RFID Module Scan was released that allows a producer or ginner to read a bar code using the device’s camera or scan the RFID tag directly if paired with a blue tooth RFID scanner. In 2018, combined efforts at the USDA-ARS gin lab in Lubbock enabled the expansion of a module tracking system from the field to the module feeder. To accomplish this, a module truck is equipped with an RFID antenna and mobile computer to receive a pickup list from the gin and record what is taken from the gin yard to the module feeder. The system has an encoder to detect the direction the chains on the module truck are moving so it is aware if the module is being loaded or unloaded. A “geo-fence” is used to mark the gin yard and module feeder so the system knows if the modules are being stored or taken to be ginned. The system was successfully tested at a commercial gin in Louisiana during the 2018 ginning season. The Louisiana test also evaluated the ability of the software to integrate with the commercial gin management software used at the gin, and several needed improvements were identified. To communicate the concept of RFID module management, a video overviewing the potential system was released under the “How to Videos” section on Cotton Cultivated in the first quarter of 2018. A numbering and hardware standard for electronic module tracking was completed by the Cotton Engineering Committee of ASABE and received full approval by ANSI with leadership from Cotton Incorporated staff.

Six Cotton Incorporated sponsored projects were devoted to exploring the technical and economic feasibility of robotic cotton harvesting in 2018. Clemson University has been testing a robotic platform and the model purchased will fit between cotton rows with a tire-to-tire width of 26 inches. The system comes with pre-built accessories so that several components are already integrated, such as a scanning LIDAR (surveying method using pulsed laser light) for obstacle avoidance. This unit achieved the ability for autonomous travel through the field in 2018 and a prototype vacuum harvest system is in development. The University of Georgia-Tifton has developed a stereoscopic imaging system that can classify defoliated cotton plants from a moving platform at 1.5 mph. Researchers are also experimenting with various methods to harvest the bolls with precision motors controlling two dimensional movement of an adapted, hand-held, cotton harvester from China. Agricultural economists at Kansas State University are evaluating the economic design parameters for a cost efficient robotic harvester. Plant and boll conformation is under investigation at the University of North Texas in collaboration with USDA-ARS and Texas A&M cotton breeders. The feasibility of ginning the cotton during the robotic harvest process is being evaluated at Texas A&M. Another
project is exploring the frequent hand harvest of cotton throughout the season to better understand the fiber quality implications of robotic harvesters at two locations, in Texas and Georgia. If the fiber quality data from frequent-harvest is significantly improved over that of once-over machine harvest, efforts will be accelerated to develop a robotic harvest system. Data from one of the sites in Texas showed a ten cent per pound premium on the frequently-harvested cotton in comparison to the machine-harvested cotton at the end of the season. This increase is based on the USDA loan chart and does not reflect any other potential value from increased uniformity in fiber properties.

In order to preserve the U.S. reputation for low contamination levels in cotton bales, research continues with all of the USDA gin labs, N.C. State University, and Texas A&M University to use advanced technologies to keep plastic out of U.S. cotton bales. A new component to this study in 2018 was the evaluation of round modules as they traveled from the harvester to the gin. Studies in Texas and North Carolina tracked modules as they were ejected from the harvester, staged on the edge of the field, loaded onto a truck to travel to the gin yard, and finally, arrived at the module feeder to discover when module cover damage is most likely to occur. If a particular phase is determined to have increased occurrence of damage, educational efforts will be focused on improving that process. Video cameras were successfully placed on the bottom of module handlers and images from those cameras are currently under review.

Irrigation has become an important risk management tool for crop production in many agricultural areas of the United States. As a result, the competition for available fresh water supplies is increasing; and in some regions, cotton producers are faced with diminishing access. If irrigated agriculture is to survive in this competitive environment, it must use irrigation water efficiently and more cost-effectively. To help achieve the goal of efficient irrigation water use, the University of Georgia has developed an interactive irrigation scheduling tool called the Cotton Smart Irrigation App, delivered as an interactive smartphone application for iOS and Android operating systems. The application calculates evapotranspiration (ET), using meteorological data and a phenology-based crop coefficient (Kc). Irrigation events, paired with precipitation from the meteorological data, help to model the daily, plant-available soil water balance within the crop’s root zone. The model reports this daily root zone plant-available soil water deficit in terms of inches of water and percent of total. The app provides notifications to the user when actions such as irrigation are needed. For example, the Cotton App sends the user a notification when the root zone plant available soil water deficit exceeds 50%, indicating that irrigation is recommended.

The Cotton Smart Irrigation App has been available for both Apple and Android devices for more than two years, but the app could only be used in Georgia and Florida because it was tied directly to weather stations in those states. A new version of the app was released and allows estimation of cotton water use anywhere in the U.S. by utilizing national data sets from the National Weather Service. Some of the regional parameters in the app are still under review, so this should be treated as a beta version outside of South Carolina, Georgia, and Florida. Tests last year found there were technical difficulties in consistently getting real time data to the app and those have been corrected for the 2018 season. Formal evaluations of the parameters are taking place in Arizona, Texas, Arkansas, Tennessee, and North Carolina. Initial results show the app performed well in the humid Southeast and Mid-south, but needs improvement for the more arid regions in Texas and Arizona.

When preparing to make a cotton replant decision, growers must consider the current calendar date and ensure that they are not getting too late into the growing season in order to have ample time to mature the crop. Replant decisions must, therefore, be made quickly within a short window after expected emergence. One proposed use of unmanned aerial systems (UAS) is to produce quantitative data to support replant decisions by assessing plant stands. Theoretically, an aerial approach could provide spatially dense information on plant populations across large areas quickly while removing human bias. Therefore, the University of Tennessee has been investigating the ability of a UAS system to accurately and precisely determine varying plant populations of cotton. A field study was conducted with seeding rates of 118,970; 33,990; 17,000; and 8,500 per hectare in order to produce a range of plant populations. After emergence, cotton plant stands were manually counted and images were obtained from two cameras mounted beneath a quad-copter UAS flying at altitudes of 30-, 60- and 75-m. True color, green, blue, near-infrared, and red-edge spectral band images were collected from the two cameras. Images were processed and analyzed for counts of plants and compared to ground-based number of plants within each plot.

Varying populations of cotton cotyledons manually counted were correlated to estimated counts from RGB and multispectral images. The estimated number of plants was highly correlated to ground-truth number of cotton cotyledons for both methods. Both types of images were able to identify a cotton cotyledon when acquired at a 35 m altitude. For both population assessment methods, as the number of cotton cotyledons within a plot increased, the number of plants estimated also increased. Although both methods evaluated were accurate, precision varied. As altitudes increased, the strength of the
correlation of the model decreased. Plants were not successfully identified flying above the 60-m altitude using the current processing methodology. It may be possible to use the higher altitude images to identify areas of the field where the stand is thin and then collect low altitude data over those areas to precisely determine plant counts. Based on initial results, the utilization of UAS aerial imagery may be a sufficient tool to improve accuracy and efficiency of plant stand assessment over current methods.

**Weed Management**

Cotton production faces significant challenges in weed management due to the development of weed resistance in several species to multiple mechanisms of herbicide action (MOAs). There are only 16 unique herbicide MOAs. All are compromised by resistance in certain species in certain areas. No new herbicide MOAs have been registered in the U.S. since 1993 (hydroxyphenyl pyruvatedioxygenase - HPPD). U.S. agriculture has progressively lost efficacy of the post emergence mechanism of action: ALS, glycine, and PPO; leaving glufosinate and the auxins – 2,4-D and dicamba, the only remaining broad spectrum post emergence MOAs available for use against many broadleaf weeds in dicot crops. Recent loss of the over-the-top PPO MOA for use on soybeans in the upper Mid-south and lower Midwest (Arkansas, Illinois, Indiana, Kentucky, Missouri, and Tennessee) have forced heavy use of glufosinate in both soybean and cotton and increasing reliance on the auxin herbicides. Use of the auxin herbicides is problematic. Both auxin herbicides select for resistance to the same MOA in weeds; however, the means by which their transgenes neutralized the effects of their respective herbicides are mutually incompatible. Thus auxin herbicides used on 2,4-D and dicamba resistant cultivars are lethal to one another. Moreover, both herbicides are notorious for off-site movement and both have had significant incidence of mishaps in their use in cotton and soybean, especially off-site movement by dicamba.

The current system of weed management is expiring. We must adopt a practice to improve and prolong current weed management programs. The national program that Cotton Incorporated advocating, in conjunction with the Weed Science Society of America and the commodity industry consortium, 'Take Action,' are:

1. Start Clean. Stay Clean
2. Use Pre/Post Systems
3. Use Multiple MOAs
4. Do not repeatedly use any single MOA unless necessary
5. Aggressively rogue escapes – seed bank management

In addition, in 2018, the department increased emphasis on new initiatives such as:

1. Use of cover crops for weed suppression
2. Development of precision cultivation systems
3. Protection of MOAs from metabolic resistance mechanism

With cooperation from the University of Georgia, Auburn University, Clemson University, and the USDA-ARS National Soil Dynamics Lab, we have redeveloped a conservation tillage system using heavy rye cover crops in areas of the Southeast where severe populations of glyphosate-resistant Palmer amaranth had forced growers to abandon reduced tillage systems and employ deep tillage for seed burial and incorporation of dinitroaniline herbicides. Similar cover crop programs are in development for Tennessee where production of sufficient biomass from a winter cover crop is difficult.

Uncontrolled populations of glyphosate-resistance Palmer amaranth were reduced to manageable levels in Northeast Arkansas by the establishment of ‘zero tolerance districts,’ where county agents, assisted by state specialists, have coordinated implementation of area-wide suppression of Palmer amaranth escapes by all means, including herbicides, cultivation, and hand rogueing. A more general application of the principles of this highly effective program is recommended.

A major assessment and education program is underway in west Texas where populations of glyphosate-resistant kochia and Palmer amaranth have been exploding since 2013. Awareness, use of soil-applied herbicides, and more timely management has improved apparent results on up to two-thirds of West Texas acres in 2015, but costs remain high. Further progress in grower practices could be made if greater use of soil-active herbicides could be achieved.
Progress with the development of reniform nematode is behind that with root-knot nematode, because no sources of resistance in *Gossypium hirsutum* were available at the inception of the initiative. However, the release of Barbren 713, derived from a *G. barbadense* accession, looks very promising.

**Disease Management – Bacterial Blight**

Bacterial Blight is a damaging disease of cotton that occurs throughout the world, but is particularly prevalent where fuzzy cotton seed is used. The causative bacteria, *Xanthomonas citri pathovar malvacearum* (Xcm), lives on cotton seed in lint and within seed, as well as in plant debris in the field. Since the advent of acid-delinting of cotton seed in the U.S. in the early 1970s, Bacterial Blight had been rare. However, in 2011 there was an outbreak in northeast Arkansas and in neighboring areas of Mississippi. In 2012, Bacterial Blight was found in 25 counties in Mississippi. Essentially no work had been done on the disease in the U.S. for more than 30 years. Formal identification of the organism from field isolates took six weeks in 2011. Cotton Incorporated initiated a project with Mississippi State University (MSU) to decipher and publish the genome of Xcm and use it as the basis for a rapid test for Xcm. The project has been successfully completed with the publication of the genome (all genes identified for the first time in science), and development, field verification, publication, and release of a qPCR method to identify Xcm in plant material including planting seed. A one-page set of instructions has been sent to all U.S. planting seed companies, the U.S. National Plant Diagnostic Network, the Iowa State University Seed Laboratory, and to all state seed testing laboratories in cotton producing states.

**Disease Management – Fusarium oxysporum f. sp. vasinfectum – Multiple Races**

Fusarium oxysporum f. sp. vasinfectum race 4 (FOV4), a highly virulent, root rotting form of FOV spread throughout the San Joaquin Valley (SJV) and is causing significant economic damage to susceptible Pima and certain Acala cultivars. FOV4 is an inoculum-density dependent disease. California extension specialists are concerned because they now see Acala cultivars that are seriously affected and are concerned that Upland cottons will shortly become as affected as are susceptible Pima cotton. Confirmation of seed transmission of FOV4 has been established, and patterns of damage in aerial photographs of some SJV fields indicate transmission by seed. In 2017, FOV4 was confirmed in two counties in a Pima cotton producing area south of El Paso, TX. In 2018, a comprehensive program of extension education, commercial cultivar evaluation, and broad screening of germplasm was developed.

Fusarium wilt, caused by FOV1, FOV2, FOV8, is also a problem in the Eastern Belt. The vascular system of cotton plants that survive to maturity may be stained with any of these FOVs, F. roseum, or F. semitectum. A systematic study of the timing of infection at the Fusarium Wilt Nursery in Tallassee, AL, has shown that FOVs may attack cotton at any time from the 2-lf stage after flowering. Samples are being tested by to determine if there is variation among FOV races in their mean time of attack.

**Disease Management – Cotton Leaf Roll Dwarf Virus**

In 2017, virus-like symptoms were observed by consultants in Louisiana, south Mississippi, south Alabama, the Florida panhandle, and southwest Georgia. Samples were sent to Auburn University and subsequently to a cooperating virologist at the University of Arizona. Preliminary identification as Cotton Leaf Roll Dwarf virus (CLRDV) was confirmed in 2018, as was its presence in Alabama, Georgia, and Mississippi. The extent of the distribution exceeded all expectations – from the Gulf Coast to Central Mississippi, the Tennessee Valley of Alabama and east Georgia, suggesting that the virus has either been in the U.S. for several years or is spreading very quickly. Symptomology seems highly variable across locations. A region near Baldwin County, Alabama, seems heavily affected with 75% or greater loss of boll set apparent in certain fields. Cotton Incorporated is working with the principal Land Grant Universities in the respective states to develop a comprehensive strategy for assessing the pest and developing a means for management.
**FOV4 Screening Program**

The 2018 FOV4 screening trial conducted near El Paso, TX, was a huge success, with approximately 1,000 lines screened. Eleven were deemed to be putatively resistant using proprietary calibration checks to access FOV4 pathogen load across the field. Resistance was determined using these checks and measured parameters including percent survival, vascular staining, and boll productivity in each plot. Breeders who contributed germplasm were offered the opportunity to visit the site in late August and have screening protocols explained in detail, with approximately 18 scientists attending.

**Pest Management**

In 2018, entomology research efforts in the Southeast primarily focused on bollworm, tarnished plant bug (TPB), and whitefly management. The research goals in this region focused on mitigating insecticide resistance, optimizing thrips management, and validating thresholds.

A regional study, including North Carolina, South Carolina, Virginia, Georgia, and Alabama, continued research investigating insect pest management of the bollworm, *Helicoverpa zeae* (Boddie), one of the most important pests of cotton, *Gossypium hirsutum* L. Cry 1Ac protein expressed in transgenic Bt cotton has been widely used for management of *H. zeae* since 1996; however, resistance monitoring efforts have documented reduced efficacy of single and dual gene Bt cotton and the pyrethroid class of insecticides in the southeast U.S., although resistance to these technologies is variable across the region. The reduced efficacy of Bt cotton against this pest has resulted in the need to re-educate stakeholders on the importance of scouting practices required to detect infestations before economic losses occur, evaluate insecticide efficacy against this pest, and to monitor development and spread of resistance across cotton producing areas in this region. Research in these three areas were the focus of this year’s project and will help to improve scouting methods and threshold development, management recommendations, and identify areas where more judicious scouting and management efforts need to be prioritized.

Following are specific objectives for the 2018 regional study and an overview of the results:

1. **Identify species of lepidopteran eggs laid in cotton fields to better understand the value of egg thresholds in an era of Bt resistant *H. zeae***: This objective was canceled. It was decided that our group would not invest time and money in molecular screening of Heliothine eggs. Despite the presence of tobacco budworm moths in cotton fields early-season, 100% of larvae collected in 2017 and 2018 from non-Bt cotton fields in Virginia were corn earworm supporting the continued use of an egg threshold in this region.

2. **Evaluate insecticide efficacy against the bollworm**: Chlorantraniliprole is the standard foliar application for escaped bollworm in cotton in the Southeast and maybe the entire Cotton Belt. A pyrethroid is frequently included in the application for stink bugs (South Carolina and Georgia) and lygus (Virginia and North Carolina). Insecticide screening trials in Virginia and North Carolina indicate that Steward (indoxacarb), Blackhawk (spinosad), and Intrepid Edge (spinetoram and methoxyfenozide) may be viable rotational options. Field performance of these products is variable across locations and years, likely from different spray timing and pest densities. Pyrethroid resistance levels, as measured by adult vial tests in South Carolina and Virginia, have decreased for the second consecutive year following their peak in 2016. Field performance of pyrethroids against bollworm in research trials (North Carolina and Virginia), as measured by the percentage of injured bolls in treated plots, remains poor to moderate.

3. **Evaluate the efficacy of commercially available Bt traits against bollworm in commercial cotton fields**: There were fewer reports of catastrophic field failures of Bt cotton against bollworm, perhaps because of increased scouting and awareness. Noticeable differences were detected between boll injury caused by bollworm in two- and three-gene cotton in surveys of commercial fields. In North Carolina damage in 66% of two-gene cotton and 19% of three-gene fields was detected. Within damaged fields only (excluding fields with zero damage), the average percent of damaged bolls was 1.7 for two-gene and 0.7 for three-gene. Maximum damage was 6% for two-gene and 3% for three-gene cotton.

4. **Define phenological susceptibility of commercially available Bt traits to bollworm and optimum timing for intervention with insecticide**: Protecting cotton in the first two weeks of bloom is the most effective timing to mitigate losses to bollworm across the entire Southeast region. If pressure in Bt cotton is high enough to justify the application (i.e., boll damage exceeds 5%), as in 2017 and some regions in 2018, spraying two-gene cotton is economically justified. Though low levels of injury are detected in three-gene cotton, there is no evidence that spraying this technology provides economic returns.
Additionally, TPB has become a more frequent problem in Southeastern cotton. In 2016, the value of cotton production in Virginia and North Carolina was just under $158 million (USDA/NASS, 2016). Cotton is both labor intensive and costly to manage compared to other field crops produced in these states. Many cotton growers face the decision of whether to continue growing cotton, despite additional expenses associated with managing insect pests, or turn to other crops that require fewer inputs. If TPB infestations continue to increase, similar to the TPB epidemic observed in the Mid-South, Virginia and North Carolina’s cotton industries may be in jeopardy. In an effort to find both effective and sustainable IPM solutions for managing TPB with reduced costs to growers and the environment, a study was replicated at the Vernon James Research and Extension Center in Plymouth, NC, and the Tidewater Agricultural Research and Extension Center in Suffolk, VA, in 2018. Researchers investigated eight management regimes including 1) a control treatment with an increased application rate of N, 2) the current standard approach for TPB management in North Carolina and Virginia cotton with an increased application rate of N, 3) standard approach with the recommended spray threshold, 4) addition of insecticide rotation, 5) addition of shortened spray application intervals, 6) addition of a single novaluron treatment, 7) addition of a lower rate of N, and 8) addition of early spray termination.

Silverleaf whitefly is one of the world’s most serious insect pests. Unfortunately, whitefly populations have radically increased throughout the southern half of Georgia over the past two years and are directly responsible for widespread economic losses in vegetable and cotton production systems. Entomologists hypothesize that these populations may result from increasingly diverse cropping systems that provide excellent year round cultivated hosts, increased survival of non-agronomic hosts due to herbicide resistance and a lack of suitable natural enemies, and climate change. Additionally, current crop specific extension recommendations are likely increasing insecticide resistance selection pressure due to repeated applications of the same active ingredients across crops. Due to direct feeding and indirect factors such as transmission of new viruses, economically sustainable production will become untenable if current trends continue and insecticide resistance appears.

To address this emerging issue, funding was provided to hire a postdoctoral researcher to coordinate whitefly research and extension efforts across south Georgia cropping systems. The post doc conducted basic research on the host range and annual distribution of whiteflies. These data will catalyze the ability to formulate science-based recommendations and will serve as the basis for development of landscape wide management plans for whitefly population mitigation.

In 2018, entomology research efforts in the Mid-South focused on bollworms, thrips, and TPB management. Growers are currently able to control these pests but at a high cost. A regional study with locations in Arkansas, Louisiana, Mississippi, and Tennessee focused on mitigating insecticide resistance in thrips and reducing the number of sprays required to control TPB and worms.

Cotton in the Mid-South is affected by a variety of insect pests that reduce yields and increase production costs. Tarnished plant bug, thrips, and cotton bollworm are the three most important pests. This regional project conducted research trials needed to provide growers with timely information on the most effective management practices to maximize returns on investment, and to predict, respond to, and if possible, delay the development of resistance.

Thrips are a widespread early-season pest of cotton, and tobacco thrips are the dominant species in the Mid-South. Insecticide seed treatments with a neonicotinoid active ingredient are the most widely used tools for thrips control. Tobacco thrips have developed resistance to thiamethoxam in recent years, leading to the elimination of thiamethoxam-only seed treatments from extension recommendations in most of the Mid-South. Experimental evidence and field observations suggest that resistance is also developing to imidacloprid, another neonicotinoid and currently the most widely used active ingredient for thrips control. This project monitored, throughout the region, the effectiveness of these two chemicals, as well as identified alternative insecticide seed treatments that could be used effectively for thrips control. In addition, aldicarb, which was formerly a widely used material for at-planting control of thrips and nematodes, has been re-introduced as a labeled product in the Mid-South. This active ingredient has been off of the market for several years, and evaluations were conducted to verify its continuing effectiveness.

Cotton bollworm remains a major pest of post-bloom cotton in the Mid-South, despite the widespread use of transgenic varieties that incorporate various combinations of insecticidal proteins derived from Bacillus thuringiensis to control caterpillar pests. Foliar insecticides are commonly used to supplement control of cotton bollworm. This regional research project evaluated the impact of these key insecticides and their ability to preserve yield in combination with the changing suite of traits.
used in commercial production of cotton. Monitoring for the continued susceptibility of cotton bollworm to one or more Bt-derived toxins also occurred.

Tarnished plant bug is consistently the most destructive pest of cotton in the Mid-South. Due to the destructive nature of this pest, its high mobility as an adult, and the relatively short period of effective residual activity for most insecticides, multiple applications are needed in virtually all cotton fields throughout much of the region, representing a substantial input cost to growers. Tarnished plant bug has an established history of developing resistance to insecticides, and ongoing evaluations were needed to verify the continued effectiveness of labeled materials. The timing of and intervals between applications also impact performance. For instance, two applications in relatively quick succession might provide more effective control than the same two applications spread out over a longer time period. This regional project sought to determine the impact of residual control of insecticides based on the interval between applications will help producers to more effectively manage this pest and maximize returns on their input costs.

Studies evaluating the profitability and insect control efficacy of seed treatments as well as for cotton including Bt and non-Bt varieties were much needed in the Southwest. Also, it was imperative to determine if pyrethroid resistance was present in Texas so growers will be better able to determine which H. zea management options might work best in their production system. In 2018, entomology research efforts from across the region evaluated the efficacy and economic profitability of preventive insecticidal seed treatments, the efficacy and economic profitability of cotton cultivars, and monitor for resistance in cotton bollworm field populations to pyrethrins.

In a separate project, Cotton Incorporated and Texas A&M continued the partnership in graduate education to address the need for trained cotton entomologists. The ongoing goal is to prepare the next generation of cotton entomologists with expertise in contemporary regional pest risk assessment techniques coupled with classical IPM approaches, designed to enhance timely pest management in fields at high pest risk within large cotton production regions. The boll-feeding/sucking bug complex of stinkbugs and verde plant bug are being utilized as the focal point of the partnership. Two graduate students and one undergraduate student were recruited and continued this project in 2018.

In 2016, a research project at Texas A&M was initiated to employ a population genomics approach to protect and advance the ongoing boll weevil eradication efforts along the U.S.-Mexico border and beyond. This project was continued in 2018 and provided a new suite of genetic tools that can be used for a range of applications including, but not limited to: 1) determining patterns of insect movement among closely-related populations to prioritize proactive eradication efforts on specific populations or regions in northern Mexico acting as sources of migrants; 2) identification of source populations in the event of re-introduction into previously eradicated areas, 3) developing accurate diagnostic tools for distinguishing among closely-related weevil species, and 4) ID of genomic regions and mapping of specific genes under selection for insecticide resistance.

To complement the work, a new project was initiated in 2018 with the USDA-ARS in College Station. This research sought to develop methods for rapidly and accurately distinguishing boll weevils from other similar-looking weevils (e.g., thurberia weevil) commonly captured in traps. Understanding these differences is critically needed to avoid unnecessary mitigation costs. Under typical field scenarios, weevils collected from traps may be dead, dismembered, and/or exposed to adverse environmental conditions for up to three weeks. Consequently, the integrity of DNA extracted from these weevil specimens may be low or too fragmented for identification via the current TaqMAN (PCR-based) assay. In order to enhance the commercial potential and adoption of this diagnostic tool, researchers must demonstrate that the assay can perform equally well on degraded weevils as on freshly-obtained specimens.

For 2018, entomology research efforts in the Far West focused on stinkbug, lygus, and whitefly management. Growers have a well-established IPM program for lygus and whiteflies but the recent increase in brown stinkbug sprays has disrupted the program. Previous results from this research in 2016 and 2017 found that spraying insecticides for control of brown stink bug provided no yield benefit and often caused outbreaks of other pests. This research was instrumental in preserving the IPM program in Arizona. An unprecedented transition in cotton insect pest management has occurred over the last decade. Growers now have the opportunity to manage their complete insect pest spectrum with selective approaches that conserve natural enemies of the principle pests. Research is ongoing to optimize the current utility of available management strategies and protect their long-term efficacy, while further efforts are being made to chronicle the industry’s successes to help support sustainability goals, show-case the progressive nature of cotton IPM in Arizona, and demonstrate to regulatory agencies the important progress made by the Arizona cotton industry and their outstanding record of stewardship.
Strategic Objective 2: Increase the long-term profitability of U.S. cotton production.

Cottonseed
Cottonseed research projects are designed to support cottonseed marketing activities by providing strong, positive, empirical data that can be used to promote cottonseed and cottonseed products. One such project is the completion of the three-year, cottonseed oil human consumption study. This research was published in a peer reviewed nutrition journal. Publicity efforts, highlighting the positive results, generated tremendous interest in the popular press. There is now strong evidence that cottonseed oil is indeed a "healthy vegetable oil." These results are consistent with the findings of research conducted several years ago. Follow-up research is being supported by the oil mill industry.

Efforts to find a way to mitigate the negative effect of gossypol on cottonseed value takes on many forms. While research to discover new ways of blocking gossypol production in the seed has been scaled back to allow a greater focus on regulatory issues, research to evaluate the nutraceutical value of gossypol (control of protozoan diseases in poultry, for example) is underway. Initial indications look promising. The planting of commercial glandless varieties has been modest in 2018 but provided enough seed for pilot scale production runs. Glandless cottonseed serves as a proxy for Ultra-Low Gossypol Cottonseed (ULGCS) in human studies and refining research.

Final review of the ULGCS Deregulation Dossier was completed by the USDA and its deregulated status was announced in September. Full deregulation by the FDA is expected in 2019. An initial consultation was held with COEFPRIOS (Mexico's equivalent to the FDA) and efforts to deregulate ULGCS in Mexico will proceed after FDA deregulation has been completed.

The brush delinter is being continuously updated and upgraded. It is in the process of being evaluated for its effectiveness at capturing some of the lost linter value, while also creating a value added cottonseed product for dairy cow feed. A new pre-cleaner is under review and modification. Beta testing of this equipment is being planned for 2019.

Agronomy – Cultivar Evaluation – Beltwide Project with Cotton Specialists
Cotton Incorporated manages a Beltwide research, demonstration, and outreach program that provides information and data about new cultivars. The program employs replicated large-plot trials with 10-12 new and standard cultivars tested at locations throughout the Cotton Belt by the co-operative extension cotton specialists. Adaptation and performance of new cultivars are evaluated under grower conditions, using a replicated large-plot test format. To present the data in a standardized and searchable form, Cotton Incorporated contracted with an outside company to develop a specific data presentation program for cotton variety performance.

Agronomy – Cotton Nutrition – Beltwide Project with Cotton Specialists
Increased yields of new cultivars and improved management by growers have pushed cotton yields to three or more bales per acre for many growers and at many locations, put a substantial demand on the cotton root system's ability to take up sufficient potassium (K) and other nutrients. As K demands have increased, deep-profile soil sampling has indicated decreasing levels of plant available K in the soils of some cotton producing areas. The frequency and severity of K deficiency symptoms also has increased on highly-productive soils over the past decade. Providing insufficient K could decrease yields and fiber quality and lead to decreased grower profits. Cotton Incorporated and the cooperative extension cotton specialists have conducted and are summarizing a Beltwide project to determine soil potassium levels in the surface horizon and at depth in several cotton production areas experiencing K deficiencies, and evaluate application methods and rates of K on cotton yield, quality, and return on investment. Based on these findings, state extension soil K recommendations will be re-evaluated and modified as appropriate to optimize yields. This project was active through 2018 and is currently being summarized for journal publication. From the anticipated publications, a national set of recommendations of cotton potassium K fertilization is expected.

Variety Improvement
Genomics and Genetics: The team working to develop five reference tetraploid genome sequences is finished and currently in the process of writing a high impact paper. The five species are Gossypium hirsutum, Gossypium barbadense, Gossypium mustelinum, Gossypium tomentosum, and Gossypium darwini. Each will reference grade, and it is expected that these will become the standards cotton researchers utilize around the world in their genetics studies.
Germplasm and Varieties Released: In addition to the four germplasm releases jointly made between the University of Arkansas and Cotton Incorporated and four joint germplasm releases between Texas A&M University and Cotton Incorporated in early 2018, additional joint releases are in preparation with North Carolina State University as well. New Mexico State University released seven Acala lines in 2018 and the USDA-ARS in Lubbock released seven Upland lines in the second half of 2018. All of the aforementioned releases have been or will be published in the Journal of Plant Registrations. During 2018 two private industry cotton seed providers signed agreements to commercialize varieties developed by the Universities of Arkansas and Georgia.

Cotton Winter Nursery (CWN): Seed for the fourth Costa Rica season was shipped and planted in October and November. There are 16 users in the current nursery. Issues continue to exist regarding the prompt payment of invoices by users.

**Strategic Objective 3: Increase number of future scientists of U.S. cotton and improve the reputation of U.S. cotton production.**

**Sustainability**

In 2018 the major focus for the department was in communicating the progress of sustainability goals in cotton. Visits were made to several major brands in California as well as to the CEO of the Sustainability Apparel Coalition (SAC) to provide in-depth discussions around U.S. cotton sustainability. Additionally, cotton was well represented through membership in the Outdoor Industry Association (OIA) Sustainability Working Group meeting and attendance at the Outdoor Retailers Association, both through presentations and discussions with brands and NGOs. While at the Beltwide Cotton Conferences, the U.S. sustainability goals were presented and discussions initiated on developing a multidisciplinary sustainability session at the 2019 Beltwide Cotton Conference. Additionally, technical presentations focused on microplastic pollution were given at the Textile Exchange and Outdoor Retailer conferences. These presentations were well received by audience members and, at the Outdoor Retailer conference, inspired representatives of Ralph Lauren to seek further information from Cotton Incorporated regarding cotton fleece technology as an alternative to synthetic fleece products. Feedback like this highlights the importance of having Cotton Incorporated actively engaged in sustainability conversations with brands, retailers, and NGOs. It is also important to ensure that accurate data for cotton is being used by sustainability professionals in the life cycle assessments (LCA) they conduct. Working with an environmental consulting company, cotton LCA data was harmonized and prepared for inclusion in the World Apparel and Footwear LCA Database (WALDB). The WALDB is a specialized data set and group of industry partners focused on providing the most accurate and up-to-date LCA data. Further research projects were explored involving land use change for cotton. To evaluate current land use practices and the environmental benefits of rotational crops, a joint cotton and peanut research project was initiated with the University of Georgia focusing on cotton and peanut rotations. This project will enroll growers utilizing the peanut and cotton rotations in southern Georgia into the FieldPrint Calculator platform. Using the output from the FieldPrint Calculator, relationships between production practices and economics will also be explored. Beyond this project, Cotton Incorporated and the American Peanut Council are developing strategies to develop sustainability initiatives aimed at growers producing peanuts and cotton.

To help quantify the environmental footprint of cotton fields in Louisiana, a grower sustainability meeting was held in St. Joseph where nearly 50 cotton growers volunteered their time and data to enroll in the FieldPrint Calculator. The project team had been working with these growers for the past several years and helped to generate significant momentum and participation. At the grower meeting, a list of best management practices were explored in real time using a live polling program. This exercise provided useful feedback which helped improve the questions as well as stimulated lively discussions around the value and opportunities to the grower for engaging in sustainability programs. This feedback is timely as the cotton industry Sustainability Task Force is in the process of creating a sustainability program to encourage more sustainable growing practices and provide a sustainability platform for the U.S. cotton industry. Over the past few years, brands, retailers, and textile manufacturers have increased the pressure on the U.S. cotton industry to develop a program to track and verify sustainable cotton within the U.S. To address this need, the Sustainability Task Force (consisting of representatives from the seven segments of the cotton industry) has agreed to create an entity and program to help track responsible U.S. cotton production. Cotton Incorporated has helped guide the creation of this system, working with existing and new staff focused on this effort at the National Cotton Council. A software company was selected by the Task force to create the electronic framework for this new accounting system. Once this system is established, U.S. cotton production will have more data and options to demonstrate the industry’s responsible production practices. The program was formally announced at the 2018 Cotton Sourcing Summit in Scottsdale, AZ as the U.S. Cotton Trust Protocol. A pilot program will be launched in 2019 with plans to fully implement the protocol during the 2020 crop year. The implementation of this program will be a major priority for
the Sustainability Task Force and the Sustainability and Agriculture and Environmental Research divisions of Cotton Incorporated in 2019.

Additionally, the Cotton Incorporated Sustainability and Agricultural and Environmental Research Divisions teamed up with John Deere’s Ag-Pro, the American Society of Agronomy (ASA), and Quail/Pheasants Forever to win a National Fish and Wildlife Foundation (NFWF) grant focused on creating Savanna bobwhite (a type of pheasant) habitat on unproductive agricultural lands in Savannah, GA. In the research proposal, Cotton Incorporated leveraged $50,000 of funding to secure a research grant of $620,000 over a three-year period. Funding from this grant will allow for the hiring of a precision agriculture and conservation specialist. This specialist, through the coordination of the project partners, will: 1) work directly with at least 50 farmers and their trusted advisers to analyze precision agriculture data in the Savanna bobwhite and other Working Lands for Wildlife species geography to improve habitat across 1,200 acres; 2) identify positive economic return opportunities through the Farm Bill and other conservation programs with these farmers and their on-farm advisers; and 3) conduct outreach and promotion efforts to increase awareness of the benefits of integrating precision agriculture and sub-field Return-on-Investment (ROI) metrics with precision conservation programs. This group was notified by the NFWF of the award on November 16th, 2018. Since the notification of the award, Cotton Incorporated’s Public Relations team met with their counterpart teams of the research partners and are collaborating to create a unified press release to announce the award and the partnership. The unified press release will be published once NFWF issues their press release, which is anticipated by the end of January 2019. This is an exciting and unique partnership that will support critical research on creating conservation lands to enhance the biodiversity on a large portion of agricultural acreage within the Georgia Cotton Belt and will help to enhance the sustainability message.

To further strengthen the cotton industry’s commitment to sustainability and continue positioning the industry as a leader in sustainable agriculture, Cotton Incorporated hired a Sustainability Manager in September 2018. This expanded capacity in the Sustainability Division allows the team to efficiently generate additional data to support cotton’s sustainability messages while simultaneously building sustainability strategies to drive cotton demand, improve public perceptions of cotton sustainability, and help growers produce more sustainable and profitable cotton.

Cotton Incorporated Fellowship (CIF) Program:
One CIF graduated in August 2018 and was immediately employed by a major agricultural company. Three new applicants will begin their courses of study in January 2019. Research topics that current CIFs will study in 2019 include cotton leafroll dwarf virus, FOV, root knot nematode, and fiber quality.
FIBER COMPETITION: FIBER QUALITY

Strategic Objective 1: Improve quality measurements of cotton fiber, yarns, and fabrics.

Quality Measurements Improvement
Elucidating the Impact of Fiber Maturity on Fiber Length Distribution and Fiber Breakage
2018 Objectives: To elucidate the impact of fiber maturity on fiber length distribution and fiber breakage.

Previous work in this study was based on commercial bales. Given a limited range of variability in the commercial bales, for 2018, a set of 129 breeder samples were subjected to laboratory scale mechanical processing to investigate the impact of fiber diameter and maturity on fiber breakage. The samples were tested via HVI®, Advanced Fiber Information System (AFIS), and CottonScope® testing. A selected sub-sample set is still undergoing evaluation on FAVIMAT for analyzing tensile properties of individual fibers. The remainder of the testing will continue in 2019.

Improving the Utility of Fiber Quality Parameters as a Screening Tool in Breeding Programs
2018 Objectives: Analyze within-plant variation in fiber quality to develop screening methods. Compare screening methods, and study the impact of trash on fiber quality assessment.

The project is analyzing differences between a traditional versus top-crop selection criteria to screen germplasm.

• Traditional: Fiber quality was evaluated from boll samples taken randomly throughout the plant canopy. The bolls were harvested and ginned similarly to those frequently used in traditional pedigree breeding programs.
• Top-Crop: Fiber samples were taken from the top of the plant. The quality of the top-crop was then used to screen the breeding material selected for advancement.

Analysis of 2017 data was completed showing differences in fiber qualities of lines selected using the traditional method versus those from selections made using the Top-Crop method. The process was repeated in 2018 and fibers were harvested for evaluation before the end of the year. Some of the selections made in these trials will be advanced to spinning trials in 2019.

For the trash assessment portion of the study, parental lines with varying fiber lengths have been crossed, and F2 progeny has been evaluated for heritability testing. The difference in heritability of clean versus trashy samples will be estimated to highlight the importance of using clean samples for fiber testing. Currently, samples have been processed on the Shirley Analyzer. HVI® and AFIS testing was completed in the first quarter of 2018. The analysis of the impact of mechanical processing on selections is underway and will be included in future reports. This project will be renewed in 2019.

Enhancing the Marketability of U.S. Cotton through Length Uniformity Improvement
2018 Objectives: Develop a strategy to calibrate the HVI® fibrogram. Investigate the suitability of AFIS length distributions and HVI® fibrogram for the improvement of the within-sample distribution of fiber length.

In 2017, it was shown that the fibrogram length curve from the HVI® does contain information about within sample variation in fiber length that is currently unused. However, this information showed variation between repetitions of the same sample indicating that the measurement would need calibration. For 2018, the researchers used a method for calibrating the fibrogram as a complete curve and successfully calibrated the fibrogram using a single HVI® as the reference machine. Principal component analysis was used to characterize variation in the fibrogram curve and for the fibrogram, three principal components can explain the entire curve. These principal components were then used in modeling to compare fiber-to-yarn quality relationships with the fibrogram versus using classic HVI® length and length uniformity data and versus using AFIS length distribution. The modeling showed that use of the fibrogram data is superior to both of the older measurement methods. This was done on a limited number of breeder samples and will be expanded to larger breeder sets across the Cotton Belt in 2019. For future use there is a need to develop an automatic method for retrieval of the fibrogram. Retrieval methods will be investigated at the Fiber Biopolymer Research Institute (FBRI) in 2019.
Maturity and Standard Fineness: Determination, Calibration, and Use

2018 Objectives: Survey commercial cotton crop to provide recommendations to cotton breeders. Identify commercial candidate bales for calibration cotton production and assessment of the variability of the standard fineness within varieties of cotton commercially produced in the High Plains of Texas.

Six of the nine cottons needed to develop maturity and fineness references have been obtained, and bale variability is being evaluated to determine appropriate sampling and blending process. All HVI® and AFIS testing has been completed for the samples being evaluated. Two of the remaining targets are hoped to be obtained via plots of a low fineness variety being managed under different conditions to get the range of maturity needed. Sample preparation and cross-sectional analysis work have begun. This project will be renewed in 2019 to continue identifying material critical to the research, as well as to continue what will be a long-term effort to complete cross-section analysis.

Finding Ginning Methods That Improve Fiber Length Uniformity

2018 Objectives: To develop, test, and report on ginning methods that improve fiber length uniformity index.

The gin treatments in this study included a conventional controlled batt lint cleaner and the coupled saw and roller gin lint cleaners at the USDA gin lab in Las Cruces, NM; the Lummus Sentinel lint cleaner in the micro-gin at the USDA, Stoneville, MS, gin lab; and possibly in the future a Cherokee lint cleaner (with reversed feed plate) at the micro-gin at the University of Georgia (Tifton). Preliminary data has been analyzed for the work done at the New Mexico lab, and it indicates that uniformity was significantly improved when cotton was run through a roller gin and conventional pin-cylinder/air-jet lint cleaner. The most aggressive ginning treatment was saw gin with conventional saw-type lint cleaner. All ginning treatments lead to varying uniformity levels for the tested material. Gin personnel at the Stoneville, MS gin lab are converting the Sentinel lint cleaner in Mississippi back to the original equipment manufactures configuration for the test and testing is expected to be completed in 2019.

Dual-beard Fibrography for Cotton Length Distribution Measurement

2018 Objectives: The objective of this project is to develop a portable, economical, and easy-to-use system for fiber length distribution measurement based on dual-beard fibrography and an iterative separation principle.

In 2017, researchers developed and implemented an iterative separation method for calculating fiber at a given length. It works effectively when the fibrogram meets the symmetry and smoothness requirements, which include that (1) the dual-beard sample should be symmetrical on both sides of the clamping line, (2) all floating/unclamped fibers must be removed, (3) the clamped fibers should be parallel and straightened, and (4) the fibers should be perpendicular to the scanning line when placed on the scanner. When these conditions are not met, the fibrogram could be skewed and fluctuate, leading to error generation in the iterative fiber separation method. To address the problems in the previous method, work was done in 2018 to introduce an optimization procedure to the fiber content estimation to minimize the errors and uncertainty. Researchers developed and verified this new algorithm. The accuracy of the new model was evaluated on reference cottons of known length. Repeatability testing was also done three times to confirm that the new algorithm provides repeatable fiber length distributions. Verification of the output was performed in two experiments confirming the model’s accuracy. The new system can now calculate all normal HVI® and AFIS length parameters. This project will be renewed in 2019.

Cotton Contamination Detection at Gin Stand Feeder Apron

2018 Objectives: Assess the best method for detecting and removing plastic contamination at the gin-stand feeder apron.

This was a new project initiated in 2018. Researchers developed new software for real-time capture of images from a low-cost camera system evaluating cotton moving at seven feet/second. The system is designed to work at the feeder apron of the gin stand where the volume of cotton is the lowest. Detection rates are best for colors of plastic drastically different from the color of seed cotton; however, detection rates of even smaller yellow plastic are now 60 to 70%. A working system was installed in a gin for evaluation this season. There is interest from a commercial manufacturer to potentially build additional prototype systems for evaluation in 2019.

Work on the laser detection phase of the project involved the selection of laser components and identification of a suitable camera. While the laser approach can detect plastics of any color, including clear plastic, it requires a very high-speed
camera due to the very narrow width of the laser. The laser detection portion of the project has not been successfully demonstrated and will not be continued. Options involving a near-infrared camera system will be investigated in 2019.

**Fiber Maturity Estimation via Seed Density**

2018 Objectives: To develop a rapid measurement of fiber maturity for use on seed cotton.

This was a new project initiated in 2018. The first half of the year was spent developing the initial research experimental designs and procuring the necessary experimental apparatus equipment (a seed singulator and counter, and a gas pycnometer to provide the gold-standard for density valuations). This project was placed on hold in order for the researcher to focus on more critical contamination removal efforts. This project will not be continued in 2019 but shall be revisited in 2020 for potential growth.

**Addressing Quality Issues for U.S. Cotton**

2018 Objectives: The primary objectives of this program are to 1) complete the development of image analysis software for automated barré detection, 2) complete a series of round trials on HVI\(^\text{e}\) elongation calibration routines, and 3) complete the implementation of Lower Half Mean Length (LHML) into commercial software.

This was a new project initiated in 2018. Data analysis was completed for the elongation calibration round trial. The trial consisted of six cottons tested with and without elongation calibration protocol on ten different HVI\(^\text{e}\) machines located at five laboratories. For each cotton, 30 tests were performed before and after calibration with the elongation reference materials. From the analysis, there does not appear to be significant variation day-by-day or between tests within a given HVI\(^\text{e}\) line. The stability of the measurement within the instrument is indicative that a routine elongation calibration, performed in parallel with other routine calibrations for the HVI\(^\text{e}\) equipment, will allow for better comparison of HVI\(^\text{e}\) data. Uster Technologies had expressed reservations about this work. Uster requested that the work only be performed on HVI\(^\text{e}\) lines which are operating on Version 71 of the HVI\(^\text{e}\) software. Version 71 contains a single-point elongation calibration, although no calibration material is available from Uster. The data from the round trial was not produced using Version 71 software. However, additional testing on machines upgraded to Version 71 showed that similar improvement could be made using the elongation calibration procedure instead of Uster’s method. Uster was sent a set of the six experimental, and two calibration cottons used in this work and have promised to provide results but have not responded to date. The manuscript reporting the results of the round trial is proceeding without Uster and it was submitted this year.

Work has been performed to consolidate the revisions to the automated barré detection software to allow a more easily deployed version to be sent to users. Work continues on the automated calculation of LHML from Fibrotest results. This project will not be renewed in 2019 owing to the completion of the fiber elongation trials. The other objectives will be continued in a separate project to be initiated in 2019.

**Research and Fiber Quality Meetings**

Staff participated in a variety of meetings including: Cotton Beltwide Conference; multiple on-site visits, and conference calls with researchers at Texas Tech, Bale Packaging Meeting, National Cotton Council (NCC) meeting on contamination; International Textile Manufacturer Federation Cotton Testing meetings; Bremen Cotton Conference; Precision Agriculture/Fiber Quality Workshop in Australia; meetings with a bale packaging company; multiple conference calls about sticky cotton; hosting an on-site meeting with researchers from FBRI; conference calls and in-house meeting with a seed company; discussions about fiber quality with Cotton Council International (CCI) visitors from Turkey; NCC Quality Task Force meeting; National Association of Plant Breeders and American Society of Agronomy meetings; trips to visit researchers at USDA-SRRC New Orleans, USDA-ARS Gin Lab New Mexico, and USDA-ARS Gin Lab Lubbock; and Clothing Care Research Center meeting in Cincinnati.

Presentations were made as follows: Contamination Panel Introduction at Beltwide Cotton Conference; What You Might Not Know About Cotton at Texas Tech; Fiber Quality presentations for a mill in Vietnam and Vietnam Cotton and Spinners Association Seminar; Contamination presentation at Lubbock Gin School; Fiber Quality presentation for Latin America EFS\(^\text{e}\) System users; Fiber Quality and Contamination presentations at Cotton Incorporated’s Spinning Seminar in Jinan, China; and Fiber Quality presentation to CCI visitors from Vietnam.
Strategic Objective 2: Provide accurate test data to support research and marketing efforts.

Product Evaluation Laboratory
Agricultural and Environmental Research
Testing for Agricultural Research was focused on general Agricultural Research Initiatives, Sustainability, and Variety Improvement. There was also testing on cotton varieties picked continuously versus those same varieties picked in 'one pass.'

Fiber Competition
For fiber testing, the following routine HVI® studies were completed on two HVI® units: twelve monthly check cottons tests, two Bremen Institute round robins, and four Commercial Standardization of Instrument Testing of Cotton (CSITC) round robins and nine USDA-AMS 220 Calibration Sets (including Pima). For fabric testing, eight American Association of Textile Chemists and Colorists (AATCC) proficiency studies and one American Society for Testing and Materials (ASTM) proficiency study were completed. For yarn testing, one TestTex yarn proficiency study was done. Lab staff also provided training on participating in CSITC to an EFS® licensee.

Global Supply Chain Marketing
Supply Chain Initiatives (SCI) which includes Technology Implementation (TI) and Technology Marketing (TM), submitted projects that included support for mills using or adopting TransDRY® technology, TOUGH COTTON™ technology, STORM COTTON™ technology, STORM DENIM™ technology, WICKING WINDOWS™ technology and sweat hiding technologies.

Product Development and Implementation
Highlights of work are listed by department:

- Fiber Processing (FP): FP initiatives involved typical support work for bale checks, evaluations of low micronaire cotton from West Texas, work on a bark removal study, TransDRY® blends and trials on cotton/wool blends.
- Product Development (PD): Testing consisted of samples for the FABRICAST™ line which were tested for basic fabric properties; if the samples contained a technology, the performance of that technology was also evaluated.
- Product Development & Implementation (PDI): PDI initiatives involved work with TransDRY® technology projects for a company, testing on a Naturals collection and testing for a denim company for strength and durability of chambray.
- Technology Implementation (TI): Testing services (often involving multiple trials for many different groups) were provided in support of the implementation of all Cotton Incorporated technologies. Technical Service was provided for several Importer Support Projects.
- Technical Services (TS): Testing services (often involving multiple trials for many different groups) were provided in support of the implementation of all Cotton Incorporated technologies. Technical services projects included evaluation of moisture management, water repellency, and durability.
- Textile Chemistry Research (TCR): TCR initiatives included continued work on non-formaldehyde options for various finishes, newness retention, moisture management work, TOUGH COTTON™ technology work and PUREPRESS™ technology.
PEL Testing Summary for 2018:

### Cotton Incorporated Activity Summary Report

**Date Range:** 01/01/18 - 12/31/18  
**Completed Projects**

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<tr>
<th>Department</th>
<th>Reference</th>
<th>Fabric (Projects/Samples/Tests)</th>
<th>Fiber (Projects/Samples)</th>
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## Cotton Incorporated
### Activity Summary Report

**Date Range:** 01/01/18 - 12/31/18  
**Completed Projects**

<table>
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<tr>
<th>Department</th>
<th>Reference</th>
<th>Fabric (Projects/Samples/Tests)</th>
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|                               |                 | **Totals:** 536                 | 1,820                    | 8,244                            |
|                               |                 |                                 |                          |                                  |
|                               |                 |                                 |                          | 226                              |
|                               |                 |                                 |                          | 29,016                           |
|                               |                 |                                 |                          | 109                              |
|                               |                 |                                 |                          | 117                              |
|                               |                 |                                 |                          | **1,027**                        |
FIBER COMPETITION: COTTON MANAGEMENT SYSTEM SOFTWARE

Strategic Objective 1: Develop and maintain software tools to buy, sell, move, and use cotton with improved efficiency and profitability.

Development
The CMS Product Development group focuses resources on designing, coding, and testing new software products for managing and improving the efficiency of cotton flow in international and domestic markets. The key directives for the CMS Product Development group are to maintain and extend key software applications.

Microsoft® has announced the eventual obsolescence of the Windows Mobile/CE platforms in the next two to three years. This is the operating system utilized by the current handheld units (barcode scanners and handheld printers) that work with the MILLNet™ software. It is expected that Android will be the operating system in these units going forward. Initial development work on the creation of the Android version for these handheld units was started in 2018.

Maintenance
The CMS Product Development group also focuses resources on designing, coding, and testing enhancements to existing software products for CMS software users.

EFS®-USCROP™ Software
Weekly updates to the USCROP™ database continued through the end of the 2017-2018 classing season. The software was then revised with the addition of the new extraneous matter plastic contamination codes and released for the 2018-2019 classing season. Weekly database updates for the new crop began with the start of the 2018 season in August and continued through the end of the year.

MILLNet™ Software Products
MILLNet™ 5.0 is Cotton Incorporated’s flagship product for managing and improving the efficiency of cotton flow in international and domestic markets and consolidates many functions that were handled by stand-alone software products in the past. For 2018, updates with general fixes and enhancements were made for this software product. These enhancements included modifications to the handheld programs for MILLNet™ software to allow scanning of zones or bins during bale storage to update bale locations for easier warehouse bale retrieval. This update will allow for easier bale retrieval when picking by bale number or when bales with categories have been scattered throughout the warehouse in multiple stacks. This software was also updated to include the new extraneous matter plastic contamination codes.

Cotton Communicator™ Software
Cotton Communicator™ software is used to generate cotton shipment documents for receipt by mills. One update for this software was released for 2018.

Strategic Objective 2: Service and market CMS™ products that promote cotton as the most efficient and profitable fiber in the marketplace.

At the end of 2018, 86 mills, gins, and merchants around the globe were active EFS® System software program licensees, and of these, there were 56 MILLNet™ software licensees.

CMS products enable the scientific use of high volume instrument data to purchase, receive, and warehouse cotton, and to select laydowns and consume cotton bale inventories. The growing global demand for high volume instrument data continues to be an advantage for U.S. cotton and builds long-term relationships between EFS® System mills and U.S. shippers that are not based solely on price.

The CMS software programs currently being marketed include:
- EFS® System MILLNet™ 5.0.015 software
- EFS® System MILLNet™ for Merchants 9.0 software
- EFS®-USCROP™ 7.0.4 software
- Cotton Communicator™ 1.022 software
Service
The CMS Technical Service group focuses efforts on providing customer service support that enables EFS® System licensees to use CMS software products effectively.

Customer Service
Technical Service answered 2,317 emails; had 173 face-to-face meetings; answered 304 phone calls; responded to 363 texts; conducted 272 Internet sessions during 2018, and provided valuable assistance to EFS® System software licensees regarding questions and updates.

Management also hosted a visit from the U.S. representative of an EFS® System licensee from Honduras to discuss fluorescence in cotton.

On-site Customer Service
Installation of MILLNet™ software was completed for seven new licensees at mills in Peru, U.S., and Vietnam. These seven mills represent an additional 411,000 bales managed by MILLNet™ software. Routine service visits were made to customers in China, Colombia, El Salvador, Guatemala, Mexico, Nicaragua, Peru, Philippines, Thailand, U.S., and Vietnam. The team also provided a requested re-training session for a group in Nicaragua.

Lost Licensees
While seven new licensees were added in 2018, four licensees were lost. A U.S. mill ceased operations, there was a management buy-out of a mill in Peru, reduced or ceased production at a mill in Korea, and one Chinese licensee that currently cannot source U.S. cotton in sufficient supply.

Marketing
The CMS Marketing group uses resources to seek out potential customers and develop effective ways to communicate the benefits of the CMS software.

Educate and Promote the Use of High Volume Instrument (HVI®) Data and CMS Software Packages
Staff provided an “HVI® Educational Workshop” with in-house training for Commercial Standardization of Instrument Testing of Cotton (CSITC) processes including a visit to the USDA-AMS Memphis Classing Office for a licensee in El Salvador. This program intends to increase confidence in USDA classing data and for the mills that must test portions of cotton to ensure that the best practices possible for this testing are being followed.

Research Potential CMS and EFS® System Software Licensees
The CMS Marketing group provided EFS® marketing and fiber quality presentations at meetings with prospective mills in Costa Rica, El Salvador, Guatemala, Indonesia, Mexico, Peru, Thailand, and Vietnam. This group also organizes or participates in information sharing including participating in a special fiber quality information seminar at the Vietnam Cotton and Spinner Association meeting. Fiber quality and contamination research efforts presentations were also made at Cotton Incorporated’s Spinning Seminar in Jinan, China.

Promotional Video Work
The full promotional video developed in 2017 was translated into Mandarin Chinese, Indonesian, Latin Spanish, Thai, and Vietnamese. A two-minute video highlighting MILLNet™ software was produced and work is nearing completion of a similar short video for USCROP™ software.

Other Activities
The certificate program to recognize EFS® licensees was launched in 2018. This EFS® Partnership program consists of issuing signed certificates in recognition of the commitment to responsible cotton manufacturing using Cotton Incorporated’s EFS® System.

Updates to TRAX, the licensees database system, included enhancements and corrections to the consumption report and consumption data. Staff also worked to update and correct details on all clients within this system.
Contract and invoice management was returned to the Intellectual Property, Contracts & Legal group. With this group’s assistance, all contract terms have been updated, and new templates exist for both U.S. and international versions of each software product requiring a contract.
PRODUCT DEVELOPMENT AND IMPLEMENTATION

Strategic Objective 1 Concentrate efforts on broadly defined key market categories where cotton has suffered significant market share erosion. Identify and research sustainable innovations in technology and product development that can recover, grow, and preserve cotton market share.

Package Preparation for Functional Finish Research

Since January 2018, the Fiber Processing Lab (FPL) has performed twenty-six winding projects in research support of TransDRY® and TOUGH COTTON™ technologies, for a total of 1,069 pounds. The FPL also processed nineteen other winding projects of various fibers, blends, and lengths in support of Product Development (PD) research totaling 1,949 pounds.

FABRICAST™ Information System – Textile Collections for Marketing Toolkits

Product Development’s FABRICAST™ fabric collections continued to be effective R&D Toolkits for marketing efforts throughout the Company. The FABRICAST™ fabric collections are used to disseminate innovative fabric and finish developments to the apparel and home markets. Fabric swatches, technical data, and fabric hangers, were used across many platforms, including traditional ones, such as seminars, technical meetings, and trade shows. On the other hand, digital platforms used high-resolution digital photos and the technical data on Cotton Incorporated’s social media and website, as well as the newly introduced CottonWorks™ site, the Global Supply Chain Marketing’s (GSCM) educational and marketing website, which was highlighted on LinkedIn, in PR press releases, and other social media.

In 2018, the fabric development team continued with their course towards increased attention on activewear and performance cotton. A narrowed focus, however, could not be at the expense of other markets; therefore, close management and monitoring of resource allocation maintained the balance to ensure 100% cotton ideas were represented while other apparel categories were still served. It appeared that activewear is leveling off in terms of offerings at retail per the Cotton Incorporated Retail Monitor™ publication, but polyester and rayon continued to challenge cotton. Denim jean offerings seemed to be on the rise, and new ideas to influence this market continued to be important. Textile collections in the FABRICAST™ information system are relevant to current market needs and meet fashion trends, with the goal of meeting the following objectives:

- Reach audiences that impact fiber selection at brands;
- Reach new companies to build opportunities influencing fiber choice;
- Expand Fabric Development’s reach, enticing more decision makers (i.e. in collaboration with the new CottonWorks™ website a major brand is placing new archival fabrics online);
- Retain and increase the number of companies requesting fabrics because of the value they add; and
- Keep industry interested with inspirational and innovative cotton fabrics.

FABRICAST™ 2018 Collection Overview

The FABRICAST™ 2018 collection consisted of 140 new knit and woven fabric developments for apparel and home markets. The new collection was made available to account managers at all Cotton Incorporated locations, requiring the Sample Cutting Room, part of PD, to cut and mount thousands of fabric hangers and swatches for distribution. All account managers received a complete set of hangers with a booklet of the swatches. Each swatch contains the technical specifications for their use in brand and retailer interactions. An overview of the various categories within the collection follows.

- **French Terry & Fleece**: Three-end French terry fabrics were constructed using a unique loop configuration, creating alternative visual interest in this collection. Blending a cotton and polyester loop yarn yielded lighter weight, flame resistant fabric (adding polyester aided in passing flammability testing). Additionally, fiber blending allows for a wider range of dyestuff utilization, providing more dyeing options. In another blend development, cotton and wool yarn were placed on the loop side of a three-end fleece. The addition of wool was a natural solution for passing flammability testing in this development.

- **Cotton Fleece – Steps toward Synthetic Fleece Alternatives**: Studies have shown that synthetic fleeces could be sending microfiber plastics into waterways; hence, biodegradable cotton fabrics were created as a step towards a natural solution. This collection of natural cotton fabrics are considered possible alternatives to the synthetic fleeces that are a main staple in current apparel markets. First, dobby and jacquard woven fabrics were enhanced
with napping and shearing in this collection for soft raised surfaces. They also featured single and double-sided surface treatments that work for both apparel and home markets. The Jacquard patterned fabrics were dyed with reactive dyes that enhanced the matte/sheen, high/low, contrast of the surface. Second, single knit-terry Sherpa constructed with a cotton core-spun around it to create an intimate blended yarn of cotton and wool in the loop. Blending wool in the napped pile of this fabric allowed it to pass flammability requirements, receiving a rating of Class I for General Wearing Apparel.

- **Performance through Technologies:** An assortment of cotton rich fabrics, using Cotton Incorporated technologies to optimize performance, greatly increased cotton’s performance abilities to the outdoor market. To expand into everyday wear, the fabrics incorporated additional performance features, further enhancing the wearer’s comfort. This collection included a group of 100% cotton fabrics featuring Cotton Incorporated technologies for moisture management. Examples of fabrics developed using the TransDRY® technology include a plain weave chambray and selvage denim, a cotton/nylon mid-weight twill, and a warp stretch denim with yarns in the filling that were treated with the technology. Other examples using the STORM COTTON™ technology include water resistant cotton-stretch oxfords, sueded oxford, a wide-wale corduroy and jersey fabrics, and lastly, a double-face, double-knit with novelty-yarn stretch inlays, and jersey fabrics. The products were further enhanced with Cotton Incorporated’s WICKING WINDOWS™ finish for outdoor active sports.

- **TransDRY® Technology + XT2® Antimicrobial Technology:** To keep a wearer cool, dry and odor-free, jersey fabrics were successfully engineered by combining them with a product from an outside yarn supplier, (XT2® antimicrobial technology with Cotton Incorporated’s TransDRY® technology). The resulting interlock and jersey fabrics constructed with a fine, 100% cotton motor vortex spun (MVS) yarn resulted in lightweight, high-end basics that have an exquisite clean look and soft hand. The advantages of using MVS yarns are lower costs, clean smooth fabric appearance with less hairiness, improvement in pilling, and abrasion resistance. A west coast loungewear brand adopted these fabrics.

- **Knit & Woven Fabrics with WICKING WINDOWS™ Technology + Phase Change Material:** Cotton Incorporated’s WICKING WINDOWS™ technology combined with a phase change material (PCM) in a print formulation provides dual performance attributes. A PCM is a wax sealed inside microcapsules, and depending on the surrounding temperatures, the wax will either melt or solidify. The wearer will get a cooling sensation from a garment with PCM because as the wax melts, it absorbs and retains the excess heat from the surrounds. Combining PCM with the moisture management benefits of WICKING WINDOWS™ technology on knit and woven substrates provides new opportunities for cotton in activewear, loungewear, home, and other lifestyle markets.

- **Performance Blends - A Durability Story:** To provide strength and improve abrasion resistance, T420 nylon 6,6 was added to a variety of knit and woven substrates. The combination of durable T420 nylon 6,6 and TransDRY® technology in plated jerseys and indigo chambrays create superior products with the enhanced benefit of both abrasion resistance and moisture management. This combination of durability and moisture management ensures longer-lasting performance products. First, a three-end fleece was constructed with T420 nylon 6,6 in the ground and tie, then was finished with STORM COTTON™ technology for water repellency. Second, a collection of durable fashion denims was constructed using a blend of cotton, nylon, and twaron in the warp. Twaron is a para-aramid that increases tear strength and abrasion performance. The Martindale abrasion tests indicated over 3x performance increase.

- **Performance Blends – Cotton/Nylon 6:6:** This is another cotton-rich performance textile, that is both technical and soft. Playing on a two-sided twill construction, a 1/70/34 nylon 6,6 warp provided strength, thinness, and a lighter weight, while the 20/1 Ne ring spun cotton provided softness in this collection. A high sheen, warp-face filament side complements a matte-soft spun side. Nylon was used in cotton-rich seersucker constructions for lighter weight, faster drying, and strength. The puckered seersucker construction lends itself to increased comfort due to less touch points against the skin, creating a light and airy feel. Cross- and union-dyeing help illustrate the versatility of this activewear blend.

- **Minimal Processing with Enzymatic Scouring:** The scouring process removes the pectin that binds wax and other impurities to cotton fibers. This is an important step in cotton processing, allowing more absorbency for even and consistent dyeing. At the same time, enzyme scouring gives fabrics a soft hand, reducing the need for softeners. Enzymatic scouring is an alternative to conventional alkaline scouring that uses more chemicals and harsher ingredients. Enzymes speed up reactions, making it possible to shorten processing time, reduce water and energy use, and reduce or eliminate chemical usage. Cotton Incorporated utilized enzymes to create a collection of knit and...
woven minimally-processed fabrics that are undyed, displaying the natural, pure color of cotton. Leaving the fabrics undyed also reduces water, time, energy, and chemical use during processing.

- **Natural Performance Blends – Cotton/Wool Denim:** When combining two natural fibers such as cotton and wool, the fabric benefits from the best properties of both. Cotton offers softness and breathability, while wool contributes its thermal regulating and odor control properties. Denims in this collection have a plied indigo warp; one version has a cotton/wool yarn in the filling, and the other has cotton/wool and cotton/spandex yarn in the filling.

- **Denim – New Garment Finishing Processes:** In collaboration with the Textile Chemistry Research (TCR) team, two new finishing techniques were applied to a bull denim (natural cotton) with an indigo base, black sulphur topped indigo, creating a more contemporary collection. First, an indigo, 3x1 twill denim, with a black sulphur top, was laser marked and then finished with the Tonello NoStone™ process. The resulting fabric was a modern version of the old school acid wash effect, but was completed in a more sustainable way, without the use of chemicals. Second, a natural color denim was pre-treated with a cationic solution prior to dyeing in pant leg form, fixing the dyes to the surface of the fabric to prevent them from distributing evenly, producing a novel mottled color effect.

- **Novelty Indigo:** Indigo continues to be an important colorant in all apparel markets. A wide variety of woven indigo fabrics was developed to highlight unique weave structures, novelty yarns, and interesting garment processing techniques, and then grouped together to create a stimulating indigo collection. The indigo knits in this collection were procured from a European indigo yarn and fabric supplier. Domestically, indigo yarn is normally not widely available for use in knitting. The quality of this sourced yarn yielded sought-after aesthetics. The textural quality of the fabric in combination with the ring dyed indigo (the outside of the yarn is blue, while the center is natural) provided a canvas for unique garment processing effects.

- **Novelty Coatings and Prints:** A variety of cotton and cotton-rich constructions were coated with fashion effects to give them unique hands and hi-tech sheens on the surfaces of the fabrics. Also, a puff dot was printed on two knit substrates creating exaggerated texture and surface interest. A vibrant tropical print against the brown hue of EarthColors®; a natural plant-based cotton sulphur-dye, is a fresh approach to traditional indigo denim.

**FABRICAST™ 2018 Collection Metrics**
Fabrics developed at Cotton Incorporated’s Research and Technical Center are important marketing resources for the GSCM group in their interactions with brands, retailers, and fabric manufacturers. The following metrics illustrate the reach and influence Cotton Incorporated’s 100% cotton and cotton-rich fabrics have in the industry. In 2018, an impressive 11,518 fabric swatches were provided to 454 companies. Out of the requests, 40% of the fabrics were 100% cotton, while 60% were blends of cotton with other fibers. Blending cotton with other fibers, such as polyester nylon, and/or rayon, reduce fabric weight, improve strength and abrasion resistance, and can accelerate dry time. Blending cotton with wool can provide thermal properties and provide flame resistance. Developing new fiber blends, not traditionally associated with cotton, allows cotton to enter new markets, slowly aiding in efforts to combat 100% synthetic apparel.

**LAMP – Liquid Ammonia Mercerization Process**
A study was conducted with a variety of knit fabric substrates, comparing conventional dyeing practices to mercerization and the liquid ammonia mercerization process (LAMP). Mercerization is a process that swells cotton fiber, changing the cross section from a kidney shape to a rounder shape. The rounder shape increases reflectivity of the fiber for a lustrous and more luxurious appearance. Traditional mercerization treats a cotton yarn, or fabric, with a concentration of sodium hydroxide (caustic soda). Liquid ammonia is an alternative application to the traditionally used sodium hydroxide. In the past, liquid ammonia processing was limited to woven fabrics, but new advances in textile processing machinery have made knit processing possible. Compared to conventional mercerization, the evenness and uniformity of swelling is better with liquid ammonia, and enhances knits in the following ways:

- Improved fabric sheen, hand, and drape;
- Low shrinkage after laundering;
- Increase in wrinkle resistance;
- Increase in elasticity;
- Improved hand;
- Enhanced tensile strength and dimensional stability; and
- Deeper colors achieved during dyeing, with improved color retention.
**TransDRY® Technology Warp**

Non-fluorine TransDRY® technology warp trials reached the final evaluation phase on the Research and Technical Center's in-house sample loom. The PD team investigated the effect of TransDRY® technology in the warp for a better understanding of how it affects moisture transport. Both end/end and solid TransDRY® technology warps were evaluated with a variety of filling combinations and weaves. The goal of the investigation was to gain a better understanding of where yarns treated with TransDRY® technology are most effective in basic woven constructions. A project with an outside mill partner was initiated to develop prototypes and bulk yardage for further proof of concept.

**Ventilation Weaving**

As an investigation into performance through construction, exploration into open weave structures for air permeability commenced. With mill partners, mock leno weave structures were built into woven jacquards to give specific zones of functionality. In the Knitting & Weaving Lab, a specific Leno modification was acquired for the PD sample loom, to permit weaving of stable open structures.

**Insulative Woven Textiles**

Building insulation into woven textiles can reduce process steps in garment manufacturing and allow for a lower profile textile-integrated lining. Using weave structures such as matelassé, thick yarns were embedded into the layers of the woven cloth.

**Cotton Blends**

Plated jersey and interlock fabric constructions were developed for a comparison study integrating cotton with a range of polymers in active tops. Different synthetic yarns (i.e. conventional polyester, wicking finish polyester, nylon, etc.) were utilized in the study. A plated jersey construction allowed one yarn to be against the skin while another yarn, plated to the outside, encouraged one-way moisture transport. Alternating yarn types, in an interlock vertical-pinstripe construction, resulted in vertical wicking due to the interplay of hydrophobic and hydrophilic yarns. Moisture management testing showed little difference between nylon and the two different types of polyester in terms of drop absorbency, wicking, and dry time.

**Longer Term Research Projects: Natural Fiber Welding, 3D Printing, Injection Molding, Spinit and CORIZON® Technologies**

The PD team continued to be involved in the research and evaluation of several novel and innovative technologies. Much of the evaluation is confidential and in the basic research stages; however, being aware of far reaching opportunities for innovations where cotton can be integrated is vital in Cotton Incorporated’s research efforts, regardless of the outcome.

**Solutions for Minimal Processing**

In collaboration with a leading enzyme manufacturer, a project was initiated to promote sustainable fabric preparation processes. A total of 17 substrates were prepared using enzymes and natural scouring agents. The GSCM team released a capsule collection, highlighting the prepared substrates on Earth Day to amplify the message.

**Screening of Phase Change Material**

Three different companies have submitted formaldehyde-free phase change materials. The TCR team screened the phase change materials to determine their effectiveness in creating a cooling sensation on cotton substrates. The phase change materials were screen-printed, then padded on substrates, followed by an application of softener to improve the hand. The focus was then to scale up the application amount of phase change materials on cotton. The TCR team has since identified alternate chemistries (low temperature binder and thickener). By tweaking the treatment conditions with acrylic PCM applications, more flexibility was provided. The TCR team finished quarter four working on optimizing the 32°C PCM application process to help with the durability of this chemistry.

**Outside Research 2019**

Product Development and Implementation received a high volume of responses to the 2019 call for outside research proposals. The Research Review Committee screened more than 65 proposals, 20 were chosen for further review. Of those, nine projects were chosen for funding in 2019, two of which are continuations of 2018 research.
Durable Softness of Hand
A new finish, which produces an extremely soft hand and is quick to dry, was developed combining a fluorochemical with silicone and a cross-linker. Both the performance and softness features last up to 30 home launderings in testing data (HLTD). This development will be added to Cotton Incorporated moisture management technologies for further testing in 2019.

Ultra-low Formaldehyde Wrinkle-resistant Finish
Research has shown that adding a low concentration of a standard formaldehyde resin will increase the reactivity of a non-formaldehyde resin (DMUG), improving the smoothness and strength retention of cotton. The durable fixation of the DMDHEU/DMUG combination, when co-applied with a SportDRY™ finish treatment, improves both the durable press (DP) ratings and the dry-times of 100% cotton. This keeps cotton soft and smooth as it dries faster.

Non-fluorine STORM COTTON™ Finish
Successful dry-time testing confirmed that fabrics treated with a non-fluorine STORM COTTON™ finish dried five times faster than untreated controls. The treatment consisted of the co-application of a wax- and silicone-based water repellent at reduced concentrations. Finished fabrics proved their durability to repel water after 30 HLTD cycles. As new products are developed, new options for enhanced performance will be evaluated for potential use in Cotton Incorporated’s moisture management technologies.

“Quick-dry” Cotton: SportDRY™ Technology
A developmental finish is being studied to help cotton dry more quickly. The treatment, referred to as SportDRY™ technology, is a low add-on finish that enables cotton to absorb less water, thus drying quicker than untreated controls. When combined with other treatments, this finish can enable cotton to dry even more quickly. For example, a developmental “super slick” treatment can be combined with the SportDRY™ technology, imparting a durable rayon-like hand that also dries faster. A U.S. brand approached Cotton Incorporated with an interest in applying this technology to woven sheeting fabric in combination with an anti-microbial and a DP resin to impart smoothness. Successful lab trials were completed and production trials are planned for early 2019.

Sweat-hiding Cotton
The applications of sweat hiding print have been expanded. Sweat-hiding printed cotton is now applicable to light weight woven shirting fabrics giving them a soft hand, durability, and making them comfortable and functional after 50 HLTD cycles. Lightweight woven fabrics require a pre-treatment that contains both a resin for smoothness and a non-durable water repellent to prevent the print from soaking through. Sweat hiding prints are also now applicable to all shades of knits with an improved C6 water repellent formulation.

Non-fluorine STORM DENIM™ Technology
Cotton Incorporated’s STORM DENIM™ technology is a non-fluorine, durable water repellent for denim. It requires three conditions to durably repel water and dry five-times faster as it permanently inhibits the growth of stain and odor-causing bacteria. The first condition is the complete removal of sizing agents, including PVA, starches, and residual oils. The next condition is the inclusion of a chelating-sequestrant synergist to remove, or bind to, the contaminants in yarn-dyed warp yarns and the co-application of the correct concentration of an isocyanate cross-linker. The last condition of critical importance is to pre-dry fabrics prior to the dry-cure at preset conditions. A new, soft hand, non-fluorinated silicone has been identified that will perform consistently out to 30 HLTD cycles.

Proton Moisture Management Quick-drying Blend Fabrics
Optimal parameters for total denier, and denier per filament, for polypropylene yarns have been identified which when knit in an alternate feed with cotton yarns, provide up to a 40% dry time reduction in AATCC TM199. This concept has been given the name Proton, a combination of polypropylene (PP) and cotton. Additionally, when testing for drying rates, utilizing AATCC TM201, the Proton fabric has only been outperformed by one 100% polyester shirt in all of the fabrics and garments that have been tested to date. The Proton fabric also shows a decrease in drying time utilizing several in-house dry time tests. Since PP is a low melt temperature fiber, experimentation was undertaken to identify a low heat setting spandex that could be used in the cotton/PP fabric. One source of low heat settable spandex was determined.
New High Efficiency, Odor-free Cationic Cotton
The concept of utilizing a new, high efficiency, no odor, cationization molecule was presented at the 2018 AATCC International Conference Event (ICE). A major chemical company officially launched this molecule at the conference. Cotton Incorporated is planning to work closely with the company to evaluate the new cationization chemistry compared to the conventional cationization product. Cotton Incorporated hosted a representative of a U.S. brand to run a trial in-house with this new cationic technology.

CO₂ Waterless Dyeing of 100% Cotton Fabric
An alkyl quat cationization pretreatment was scaled up to treat a pilot amount of fabric for 50-yard lab scale dye lots at a dyeing company. The attempt to scale up this technology was met with some difficulty, as it appears that the treatment migrated, and the quat recommended by the supplier is not as effective as other specialty quats. Further research has demonstrated that a different approach utilizing a combination chemistry showed excellent exhaustion of disperse dyes from water. Additional work is needed to determine if this same effect can be seen in a super-critical CO₂ environment.

Cotton to Sugar
Over 150 hydrolysis experiments (24-72 hr.) have been performed with the goal of utilizing end-of-life cotton textiles as a biomass to generate and convert into glucose; creating new value-added products such as ethanol. Using a bleached cotton interlock as substrate, approximately 85% glucose has been obtained. Recently ~ 30 different garments were hydrolyzed and analyzed. As an estimate, about 75% of the garments hydrolyzed have obtained 60-70% + efficiency. This is very encouraging for a process not optimized with garments of unknown dyes and finishes. Additionally, recent meetings from the outside research group working on the economic analysis of our project suggests a ton of colored garments may be as little as $0-40.00 per ton.

Cotton Module Wrap
Initial research is being carried out to develop ideas to replace a layer of the cotton-module wrap, utilized for harvesting and transporting cotton from the field. When the module wrap is not carefully removed, contamination of the final cotton product is possible. Samples of module wrap were obtained and submitted for testing to determine the baseline physical parameters that need to be met by an alternative option.

Outside Research – Green and Efficient Textile Dyeing and Finishing Technology
The objective of this project is to develop a process to color cotton with dyed nanocellulose. In theory, the process should utilize much less water and energy than a conventional reactive dyeing process. Samples of commercially available dyes with known structures have been applied to both knit and woven 100% cotton fabrics. The colorfastness of samples dyed with the nanocellulose approach were considerably lower than the conventional reactive dyeing process. As a result, new options were explored to apply and bind the nanocellulose to cotton fabrics including additional crosslinking reactions and an in-situ application of the nanocellulose. Additionally, much effort was spent on improving, or lowering, the stiffness of these dyed fabrics by polymer modification. Due to the encountered challenges, this research was not renewed for additional funding for 2019.

Outside Research – Six Sigma Approach to Dyeing
The objectives of this project are to quantify the actual savings realized by commercial firms adopting a lean six sigma approach to cotton dyeing. This project ended in 2018 and was very successful. The dye plants’ machine utilization improved by 19% from 69% to 88%. After analyzing data, difference in the liquor ratio between the lab and the plants turned out to be one of the main root cause and suggested corrections were implemented. During the AATCC Fall committee Meetings, PDI staff presented the findings to the Chemical Interest Group. A publication is underway because of gained interest from the presentation.

Dyeing of Cotton/Wool Blends
Fabrics made with blended fibers have gained popularity in many apparel markets. The PDL is creating cotton/wool blended fabrics that, ideally, incorporate the benefits of both fibers such as comfort, warmth, moisture management, and breathability. In order for the development of fabrics containing cotton/wool to be successful, proper dyeing techniques are, being developed to provide the desired shades while maintaining the required fastness and aesthetic properties. The knowledge and familiarity gained from dyeing these cotton/natural fiber blends will help to produce samples that offer cotton and wool blends as a viable alternative to synthetic and synthetic blend fabrics in existing and emerging markets.
Non-formaldehyde DP Patent
The TCR team discovered a patent-pending modification to a new non-formaldehyde DP technology that provides textiles a boost in strength and abrasion resistance. The concept was tested and validated, through production-scale trials, in Peru, China, and Thailand to verify the benefits of the new technology. The utility patent and international application (PCT) patents for Bangladesh and Pakistan were issued in September 2018. Marketing staff is promoting this as PUREPRESS™ technology. Several brands are currently evaluating this new technology under a confidentiality disclosure agreement (CDA).

Safer Flame Retardant Technology for 100% Cotton Fleece
Research is progressing toward applying a phosphorus-based flame retardant technology to 100% cotton fleece using a non-formaldehyde crosslinker to make it durable. This will provide an alternative to blending polyester into cotton fleece fabrics to pass the General Wearing Apparel Flammability Standard (ASTM D1230). Pilot-scale trials in the Dyeing & Finishing Applications Laboratory (DFAL) were conducted, and further application trials are in progress on several different fabric constructions.

3D Printing and Injection Molding Using Cotton
Pulverized cotton (flock) was combined with polylactic acid (PLA) derived from corn and polypropylene in different ratios for injection molding into commercially viable products (coffee mugs, toothbrushes, pens, coat hangers, etc.). This project is ongoing with regard to evaluating the benefit of using cotton as a composite filler. Some benefits may include neutral color, increased strength, lower cost, and the displacement of plastics.

E-Textile Research
The TCR and PD team worked together to create a woven textile with an integrated heating element. This fabric was constructed with cotton yarns and yarns composed of insulated copper wires wrapped in cotton. The conductive yarns were attached to a battery to achieve a heating effect. Further discussions with the yarn manufacturing company continued to improve the functional properties of the yarn. Fiber optic yarns were incorporated into knitted structures to begin assessing viability of the material.

Clothes Care Research Consortium (CCRC) Data Analysis
The laundering data sets that have been generated through sponsored CCRC research are being analyzed, reviewed, and compiled into presentable information. The ultimate goal of this work is to understand the effect various factors such as detergent, temperature, laundering cycle, washing machine, and dryer type have on fabric properties. This information will be organized in a simple format that can be used as a tool to educate the consumers on the correct laundering protocol for improved fabric care.

Dyneema® Non-fluorine STORM DENIM™ Finish
The TCR team has conducted research combining Dyneema® fiber and Cotton Incorporated's non-fluorine STORM DENIM™ finish. A finish for denim was developed that repels water after 30 launderings and dries five-times faster than the controls. When the finish is cured as low as 125°C (257°F) for 20 minutes, it enables Dyneema® fiber to maintain its strength while being treated with the non-fluorine STORM DENIM™ finish for increased durability. The denim finish was adopted for motorcycle denim by a major brand.

Soft-hand C6 STORM DENIM™ Finish Plus Antimicrobial
The TCR team worked with a major brand to develop a technology with a soft hand and antimicrobial properties. A production trial to this effect on blue jean jackets ran successfully in February. The jackets treated with a C6 STORM DENIM™ finish plus an antimicrobial technology had a softer hand. The major brand has since released the jackets to market.

Dischargeability Study with Reactive Dye Primaries
This ongoing project involves dyeing 100% cotton interlock-knit fabric swatches, using all of the major reactive dyes available in the industry, as provided by the four major global dyestuff manufacturers. All of the reactive dyes were dyed-out at eight different percentage levels, with a larger swatch dyed-out at a set level of 3% owg. After dyeing, the primaries were measured by the spectrophotometer and stored as colorants to be used in formulation predictions. In addition, each dyestuff was evaluated to determine its degree of dischargeability using newer, more sustainable methods such as laser technology,
ozone, and other environmentally friendly alternatives to potassium permanganate. Swatch books containing the original and discharged swatches will be assembled for easy reference in future development projects.

**Potassium Permanganate Alternatives**

Trials were conducted which evaluated chemical alternatives to bleaching fabrics with potassium permanganate. Potassium permanganate is a widely used chemical in the denim industry to bleach-down or discharge color from textiles, providing a vintage look to garments. This chemical is known to be harmful to the environment. Pressure is mounting to find environmentally friendlier alternatives, thereby eliminating the need to use potassium permanganate. These trials have resulted in several samples in the FABRICAST™ collection highlighting this new alternative technology.

**Outside Research: Sleep Comfort Study**

Data collection in this project involved a thermal manikin and was completed at the Royal Melbourne Institute of Technology (RMIT University), located in Australia. Microclimates generated within a 100% cotton, cotton/polyester, and 100% polyester garment and sheeting sleep environment were evaluated. The cotton and cotton/polyester environments were more conducive to a restful night sleep than 100% polyester sheets and garments, keeping the wearer cooler and drier through the sleep cycle.

**Outside Research: Microfiber Degradation in Aqueous Conditions**

Work continued on the degradation of cotton and other fibers in aqueous conditions, and the release of these fibers during laundering. Knit fabrics composed of these fibers were subjected to conventional laundering. The wastewater was filtered and the fibers were collected, counted, and characterized. Cotton and rayon fabrics released more fibers than polyester fabrics. Trends were similar to accelerated laundering, only on a smaller scale. The different fibers were then exposed to water collected from a wastewater treatment facility, a freshwater lake, and coastal seawater to determine if they would decompose in those environments. In every aquatic environment, cotton and rayon fibers degraded while polyester did not degrade.

**Internal Garment Dyeing, Laser, and Printing Activities**

The number of projects processed through the digital printing lab, laser etcher, and garment-processing area totaled 60; consisting of 390 panels, 461 garments, or 349 yards of fabric.

**Internal Dyeing, Finishing, and Analytical Activities**

The DFAL completed 134 projects with 345 samples. Consisting of 5,868 pounds or 6,956 yards of processed fabric. The Analytical Laboratory (AL) completed 146 projects, analyzing 1,363 samples.

**Wear Trials – SportDRY™ Antimicrobial Finish**

A developmental technology, SportDRY™ finish, was tested for both durable softness and the prevention of malodor. The SportDRY™ finish tested contains a soft-hand C6 fluorine water/oil repellent, co-applied with an antimicrobial finish. The t-shirt treated with SportDRY™ finish was worn, every day, for 11 consecutive days, during strenuous exercise, burning over 600 calories per workout, to saturate the treated garment with perspiration. The following observations were found valuable in leading cotton to become a front-runner in the fitness apparel market:

- Without laundering, the SportDRY™ antimicrobial finish failed to produce odor-causing bacteria after 11 days of continuous use of the treated garment.
- When sweat is utilized as a food source by bacteria the residual sedimentation left on a garment leaves a harsh hand. When air-dried, the garment treated with the SportDRY™ antimicrobial finish did not allow bacteria to utilize sweat as a food source, maintaining its softness of hand after drying.
- Two test methods confirmed the durable inhibition of bacteria (the AATCC TM100 and the Shaker Flask method). The athletic wear treated with the SportDRY™ antimicrobial finish not only inhibited the growth of stain and odor causing bacteria after sweaty garments were stored in a backpack, but it also inhibited the growth of odor causing bacteria on the garment as it was being worn in the gym.
- Treated garments exhibit a permanent brightness or whiteness of shade after laundering. The SportDRY™ antimicrobial finish has not allowed the garment to yellow or lose its brightness/whiteness after continuous use.
Cotton Incorporated Technology Implementation

Implementation of chemistry intended for TOUGH COTTON™ technology on knits and woven fabrics continued to be a primary focus of TSI in 2018. New adoptions continued to develop in this technology, resulting in high demand around the globe. As demand continues, time running trials and performing testing will remain high.

- Activity in South American mills continued to expand at the request of U.S. brands and retailers. Several brands requested specific trials in support of their TransDRY® and WICKING WINDOWS™ technologies. In 2018, four trips to South America were in support of the moisture management capabilities of mills there.
- Three technology implementation trips in early 2018 were to support a newly developed Non-formaldehyde Durable Press Resin (PUREPRESS™) technology. Trips to Southeast Asia and South America to run testing on the initial phase of the technology finished with high success. Due to initial success, later trials in Peru were to implement the (then patented) PUREPRESS™ technology. Followed by trials in Southeast Asia and mainland China.
- A joint TSI and TCR trip to mainland China was made the first quarter of 2018. Eight mills were visited on this trip to support research and implementation efforts on the non-fluorine technologies STORM DENIM™, TOUGH COTTON™ without resin, WICKING WINDOWS™, TransDRY®, STORM COTTON™, and PUREPRESS™ finish. Trials were also run on new non-fluorine chemical options for yarn treated with the TransDRY® technology.
- The TSI team was also involved in the research and experimental-implementation efforts of the TransDRY® technology. New application ideas were explored for the technology, with additional research ongoing.
- A large STORM COTTON™ technology program remains strong at a domestic mill. Three visits were made in 2018 to assist in monitoring production for this program.
- There have been six domestic mill visits in 2018 to provide implementation and technical service support to domestic mills. The TSI team has assisted these mills with processing issues such as barré, preparation, mercerization, dyeing, technology-related problems, shrinkage, holes, and yellowing.
- Implementation efforts continue to support a new market category at a domestic mill on the west coast. Visits began in the fall of 2017 to support its STORM COTTON™ finish adoption, with trials continuing into 2018.
- In total, TSI was in contact with roughly 116 mills, supporting projects for 55 brands and retailers.

Strategic Objective 2: Optimize and implement products and technologies to advance cotton in global markets.

Cotton Variety Study for Major Seed Producer

The Fiber Processing (FP) team conducted a comprehensive spinning comparison of two new Upland seed varieties to an existing successful variety from a major seed producer. Quality fiber-processing data is not only useful to supply chains but is extremely useful to breeders. First, a standard, Ne 30/1 carded ring yarn, from each variety, were spun to provide a control for comparisons, to both current and historical variety trials. In addition, both Ne 40/1 and 60/1 combed ring yarn were spun for knit fabric samples. The Ne 40/1 combed yarn was knitted into a double-knit interlock fabric, dyed, finished, and delivered back to the seed company. The Ne 60/1 combed ring yarn was later knitted and presentation hangers were produced for delivery to the seed breeder. The FP team, along with other members of PDI, delivered a successful presentation to the seed company’s breeders, and senior management, detailing the fiber and spinning data recorded. Results were positive and demonstrated that a count this fine can be successfully produced from an Upland variety. In August, the FP team and other members of PDI participated in additional presentations with the seed company’s breeders, further summarizing the yarn and fabric performance. The successful seed variety from this study is commercially available for the market. After completion of the last presentation, all parties agreed to continue our joint efforts regarding seed variety studies on a yearly basis. This provides Cotton Incorporated the opportunity to evaluate and grow the fiber of the future.

Low-mic Cotton Research

With the volume of low-mic bales from the 2017-18 crop (3.76 million below 3.5 mic) the FP team wanted to provide an accurate detailed analysis of potential product-channeling that would yield the most successful utilization of this cotton. Research this year focused on low mic cotton to target achievable quality results in yarn. Examination into laydowns representing a sub-three and sub-four mic cotton were compared to a control of 4.7 mic cotton. Production of both ring and open-end yarns, in Ne 6/1, 12/1, and 18/1 allowed for a closer study of obtainable physical results. Final data was compiled in June with a full technical report released in July. The data is now available for technical service implementation by FP staff to
interested operations and to the GSCM managers for their customers. The data is vital in guiding spinning operations towards a more successful utilization of low-mic cotton readily available in the marketplace.

Technical Service Meetings with Yarn Spinners and Manufacturers
In late 2017, GSCM requested FP’s technical support in Latin America with major spinners and manufacturers. After determining the Latin American partners’ technical issues, in-house testing on raw fiber, up through yarn, commenced. The FP team compiled support data and then in February conducted technical service visits in Mexico, Colombia, and Peru. Technical discussions and mill audits held with the technical staff, and upper management groups, effected positive feedback at all operations as well as their continued use of U.S. cotton.

Muratec 870 III Vortex Spinning Machine Installed
The FPL installed the latest generation of airjet spinning, the MVS III 870, in efforts to continue to support the company with innovative research on cotton yarns. The MVS III 870 delivers more stable, improved quality yarns at speeds up to 500 m/min. Features of the newest generation include: a redesigned piercer carriage and doffer, a better-streamlined, more intuitive internal Visual on Demand System (VOS) and a more simplified, ergonomic drafting system. Throughout the year, the FP team has continued to analyze its upgrades and components, comparing the performance of the 861 generation MVS to the 870. Product range evaluations continue to determine minimum and maximum yarn capabilities. Joint strategy sessions have commenced to plan a large research project with PD examining mid-to-fine count combed yarns. This research will continue into 2019.

Installation of Amsler Core Spinning/Wrapping Technology
In September, FP staff and Amsler technicians installed components for the latest generation of core spinning and yarn wrapping technology. The core spinning technology will enable FP to perform research on yarns with various core materials that can better enhance the utilization of cotton and improve its competitive position as a fiber in the marketplace. To date, Cotton Incorporated is the only facility in the U.S. to have this yarn wrapping technology. The final component for this installation, the Amsler STG 5000 Controller, will arrive prior to the end of December 2018. This technology will deliver a softer, lower twist yarn, which will present another competitive advantage for cotton over other fibers.

Upgrade Existing Autocoro 8 to New Generation Technology
The FP team maintains partnerships with all significant machinery manufacturers to assure awareness of available technology advances. Saurer/Schlafhorst informed FP of cost-saving upgrades available to the existing Autocoro 8 rotor-spinning machine enabling future technology improvements without the purchase of a new machine. The upgrade would cost of $6,000 versus $200,000 for a new generation machine. Enhanced power supply units for all positions are on order to achieve the necessary upgrade. As rotor spinning accounts for a large percentage of the spinning capacity and cotton consumption globally, it is critical that FP maintain the latest version of this technology. The components arrived in late December for installation in early 2019.

Importer Support Program (ISP) Workshops
The PDI team provided resources and staffing for the following ISP workshops hosted at the Cary, NC, headquarters:

- Garment Wet Processing
- Denim Manufacturing & Garment Finishing
- Textile Fundamentals
- Modern Printing Science
- Sweater Manufacturing & Design

Individualized Brand and Retailer Textile Classes
The PD team connected with the industry by instructing a textile course introducing a computer and accessories company to the fundamentals of cotton processing, from cotton plant to finished product. By ensuring cotton is part of the conversation for products that fall outside the traditional apparel space, Cotton Incorporated facilitates the potential for increased cotton use in nontraditional markets. This class supported Cotton Incorporated’s marketing efforts in building a better understanding of how cotton fits in with sourcing and fiber choices. The PD team served as instructors to two major retailers, providing insights on textile processing from yarn to finished fabric.
Internal Product Development Services
The PDL produced and sourced knitted and woven fabrics supporting research activities in the following departments: FP, TCR, TSI, and GSCM. This support service within the company resulted in the machine set up and production of a variety of knitted and woven fabrics, either of a specified construction or in mechanical blends with experimental polymers. Successful collaboration between PD and TCR resulted in a sweat hiding technology that was adopted by a brand and is available at retail.

Internal Swatch Cutting Services
In addition to preparing the FABRICAST™ 2018 collection materials, the PD Sample Cutting Room provided swatches for a wide range of company activities including customer meetings, ISP workshops, account manager requests, fashion trend presentations, and trade shows. During 2018, roughly 27,000 swatches and hangers were processed.

Technical Assistance – Knits and Wovens
The PD team provided industry standards and technical guidance to fabric mills, universities, converters, knitting machinery companies, and apparel brands covering technical fabric layouts, setting up complex knit structures, fabric predictions, sourcing, and instruction on leading machinery types.

Inter-departmental Technical Assistance
PDI worked closely with Fashion Marketing to form their general, active, and denim trend presentations. Knit and woven garments were analyzed, then cataloged to understand more about the yarn type, knit or weave structure, weight, finishing details, and other descriptive information. Data was stored, building libraries to sustain future research. The PD team provided information and internal development images of the FABRICAST™ collections including swatch packets of product development fabrics to amplify cotton's potential in brand and retailer presentations.

Non-formaldehyde Durable Press Resin
The project to replace current formaldehyde-containing resins is successfully continuing. In 2017, the production trials had been largely based on bottom-weight woven fabrics. In 2018, trials were focused on woven shirting fabrics. Trials were successfully conducted at mills in Thailand, China, and Peru on high-end shirting fabrics. This new technology provides similar smoothness ratings with enhanced tensile, tear, and abrasion resistance. Several brands are currently evaluating this new technology under a CDA.

Strategic Objective 3: Augment cotton marketing activities/influence industry decisions through technical avenues such as standardization and education.

Cotton Life Cycle Analysis (LCA) Updates and Presentations
Use and availability of the 2015 cotton LCA data continued to spread. During 2018, 93 downloads of the full report occurred from 77 unique requests, which total 264 downloads since it was first posted in July 2017. The results are available in one of the major LCA databases, and a consultant converted the background dataset to allow import into the other major LCA data source. In 2018 updates to the SAC’s Materials Sustainability Index, all of the cotton processes now contain the most recent life cycle data. Other efforts to publicize the results are taking place through publications and through presentations to professional groups. The 2018 AATCC ICE included a presentation in the retailer session that covered consumer energy and water usage in the LCA. There was great interest and many questions afterwards from the audience of about 100 people. Another presentation on challenges in LCA for agricultural systems was given at the American Society of Agricultural and Biological Engineers (ASABE) conference.

Sustainability Organizations and Index Developments
In The Sustainability Consortium (TSC), contributions were made to improving textile toolkits by including Key Performance Indicators (KPI) for environmental and other impacts of each major type of fiber (plant-based, animal-based, and synthetic/manufactured). Other changes to KPI response options and toolkit methodology are being discussed. Participation in the Idea Forum provided new strategies to meet sustainability challenges and to communicate sustainability results.

The Higg PM was the focus of efforts in SAC. After completion of pilot testing of the PM, feedback was addressed in materials and use phases, and chemical assessments were incorporated. Product Integrity was part of the development of qualitative chemical evaluation this year, which was used to score various certifications. A project at a European university that will
provide better quantitative scores for chemistry was identified for 2019 funding. Finally, the overall methodology was approved by the membership at the end of the year.

**Microplastic Standards**
Test methods for assessing the magnitude of the microplastics released from fabrics are in development at both AATCC and ASTM International. Product Integrity contributed to both committees; however, these standards will take more research to develop fully. Life cycle metrics are another area of interest that may be useful to demonstrate the consequences of synthetic fiber use. Several LCA organizations are investigating possible approaches and in the fourth quarter, as part of an Outdoor Industry Association (OIA) research cohort, new research on microplastics was outlined. Research will kick off in 2019.

**Denim Safety Guidelines**
Cotton Incorporated participated in an AAFA-coordinated effort to improve safety in denim laundries. A consultant developed a set of safety guidelines with suggested actions accompanied by a list of hazards and pictures, and general safety information. AAFA published the guidelines for members to use with suppliers.

**Technical Conference and Mill Meetings in China**
The FP team gave a presentation at a spinning conference, *Optimized Cotton Processing: Moving Toward Sustainability in the Supply Chain*, held in Jinan, China, in April. Seminar attendees included 69 representatives from 27 companies located in the Shandong Province. Immediately following the conference, the team spent three days providing technical services at textile mills in the region. Instruction addressed the optimal processing of cotton fiber, citing issues presented by GSCM staff from both the U.S. and China.

**ANEX Nonwoven Exhibition – Tokyo**
Fiber Processing provided support to Nonwovens Marketing in June at the ANEX 2018 nonwovens exhibition in Tokyo, Japan. This three-day exhibition is the most influential of all Asian nonwovens exhibitions. Cotton Incorporated joined over 300 exhibitors with an average daily attendance of 10,000. Many impressions and technical discussions took place as staff from four Cotton Incorporated offices reached out to the complete international nonwovens’ supply chain, including machinery manufacturers and major brands. Today, Asia is considered the trend-setting region for the world. Cotton has gained increased interest from many Asian nonwoven consumer product manufacturers.

**Technical Service Support for a Major Cotton Bleacher**
The FP team, in partnership with the Product Evaluation Lab (PEL), provided technical service support for a long-term evaluation project to assist in the determination of optimum machinery settings for a major cotton bleaching operation. The operation installed several pieces of new equipment and evaluated samples from each at a range of settings. This technical service support took place over several months and has enabled the bleacher to reach conclusions that optimized their operation for the continued delivery of quality, bleached cotton to their customers.

**Design for Disability**
The PD department partnered with the Strategic Alliances department to support the Cerebral Palsy Foundation’s, *Design for Disability*, fashion show held in May in New York City. Fashion design students from Pratt, Parsons, and FIT were mentored by American fashion icon Anna Sui, to create clothes that individually addressed the needs of people with disabilities, including those with prosthetic limbs or who use wheelchairs or walking crutches for mobility. The PDL provided a wide range of cotton rich fabrics, offering stretch and breathability for the apparel students to work with in their designs. The subsequent fashion show illustrated the comfort and functionality of Cotton Incorporated’s fabric developments.

**In-house and Outside Meetings**
Several in-house and outside meetings with major domestic brands and retailers, woven and knit fabric manufacturers, fiber and yarn suppliers, an advanced materials library, a specialty coatings company, as well as chemical and dyestuff companies took place during the year.
Trade Shows and other Industry Connectivity
The PD team attended and provided exhibition materials, including fabrics and garments, for the following trade shows:

- Outdoor Retailer Show, U.S.
- Premiere Vision Apparel Fabrics Trade Show, France
- Denim by Premiere Vision, France
- Techtexil North America/Texprocess Americas, U.S.
- Shanghai Intertextile, Hong Kong

Team members scouted the shows, gaining inspiration for developmental concepts, new cotton yarn and fabric sources, and met with vendors to discuss possible collaborations. The PD technical staff assisted account managers in the Cotton Incorporated booths at Premiere Vision, Outdoor Retailer, and Shanghai Intertextile, presenting new fabric developments and answering technical questions.

Numerous meetings were held with major brands and retailers in the U.S. as well as their sourcing arms in Asia. This included a three-week presentation trip to Shanghai Intertextile Trade Show with one-on-one meetings, followed by presentations and meetings in Hong Kong, Bangkok, Tokyo, and Seoul.

Industry Mentorship and Involvement
Product Development staff participated in critiques for undergraduate and graduate student work at major textile universities, served as judges for a AATCC university student fashion curriculum competition, served on the Career Advisory Team for a public school system, furthering cotton in high school curriculums, and served as an international judge for the Future Textiles Awards through WTIN.

AATCC International Conference
The annual AATCC International Conference was held in Greenville, SC. Several PDI staff attended the event which offered opportunities to attend technical presentations on key textile-related topics.

AATCC Spring Meetings
Members of the PDI team participated and attended various AATCC Committee Meetings, Special Interest Group committee meetings, conferences, and workshops.

Conferences and Research Trips
- Conferences revolving around electronic and 3D textiles were held in England and the U.S.
- New connections were forged, creating new opportunities for future collaborations with four textile universities in Scotland and England.
- Research was presented during visits to the Heriot Watt University in Scotland; the University of Leeds in Nottingham, England; Trent University in England; and Central St. Martins in England.
- Low water use and milder chemical alternatives were explored during a research trip to Europe. Sustainable fabric and experimental garment processing trials were conducted at textile chemical and machinery companies in Italy and Spain.
- The RISE (Research, Innovation & Science for Engineered Fabrics) conference on nonwovens and smart textiles was attended in North Carolina.
- A Digital Printing Conference hosted by AATCC was attended by textile developers in PD.
- Research associates in Australia were visited along with a large cotton seed processor and gin.
- Research was presented at a fiber conference in Austria, a home textiles conference in New York, and a sustainability conference in Vancouver.
Test Method Development
Determination of the limitations of current test methodologies is required to ascertain how testing can be modified to consistently and accurately compare comfortable cotton treatments, how synthetics compare, and laundering durability. The following methodologies have been under review by PDI.

- Durable water repellency testing, in the TCR lab, studies visual-shade change on the outside surface of a spray tested fabric (AATCC TM22) to compare absorbency, evaporation, and soak through. These findings are used to quantify and qualify water repellency. New testing methods suggest a critical step in improving the water repellency test, after multiple launderings, should require additional evaluation in the way timing is determined when evaluating the shade of a visual-spray rating. Judging a color change as pass or fail without factoring in the depth of shade change and how quickly the shade change disappears (in less than five minutes) may pave the way for us to help develop a new durable water repellency testing protocol.

- Dry-time testing and modified hot water (100°F) absorbency testing accurately and consistently determines the maximum saturation potential, along with minimal retention, to create a moisture management “wear window.” A new theoretical dry-time calculation was developed to include the maximum saturation potential of a garment in combination with the dry-times at minimal water retention percentages. Potential standards have been determined to qualify the durable application of the functional finish as developed and/or improved at Cotton Incorporated. For example, fabrics treated with SportDRY™ finishes dry three times faster than their control, whereas fabrics treated with STORM DENIM™/STORM COTTON™ finishes dry five times faster than their controls after 30 HLTD cycles.

- Laundering abrasion assessments compare dye washfastness and the durability of functional finishes when garments are washed right side out and inside out. When washed inside out STORM DENIM™ finishes exhibit improved water repellency and improved newness retention (colorfastness). A jersey with SportDRY™ finish has no fuzzing on the outside surface when washed inside out to maintain a super soft hand while drying three times faster.

- The performance of non-fluorinated moisture management finishes are hindered by the presence of residual detergents in the fabric. Testing has found that detergent can be removed after multiple launderings by adding three detergent-free laundry rinses following the final wash. Without the removal of soaping agents from blue jeans treated with STORM DENIM™ finish, the water will soak through the treated goods when spray tested after 30 HLTD cycles. After three detergent-free laundry rinses, the same fabric has zero soak through when spray tested; water repellent garments do not allow you to get wet.

Industry Activity and Interaction
Numerous in-house meetings, outside meetings, and conference calls took place during 2018. Members of PDI held face-to-face meetings and conference calls with chemical suppliers, garment machinery companies, mills, brands, and universities. The interaction with chemical suppliers and machinery companies included multiple process trials and informational meetings. The conference calls with the universities involved discussion on the progress of outside research projects.

AATCC International Conference, Workshops, and Meetings
Members of PDI participated in and attended the annual AATCC ICE, and other various committee meetings, special interest group committee meetings, conferences and workshops during the first half of 2018. Two PDI team members each gave separate presentations in the Chemical Applications Interest Group track; New Approaches to Dyeing Cotton with Lowered Environmental Impact and Yarn Upgrade: Can Bio-polishing Impart Combed Ring-Spun-like Characteristics to Carded RS and OE Yarns. In addition, one PDI team member served as moderator for the Coloration and Chemistry Session during the conference. In the Chemical Applications Interest Group, the TCR team member served as the Chairperson and as a member of the Board of Directors for AATCC, along with serving as Chairperson for RA34 Preparation Committee.

Importer Support Program (ISP) Workshops
The TCR team provided resources and staffing for the following ISP workshops hosted at the Cary, NC, headquarters:

- Garment Wet Processing in February
- Denim Manufacturing & Garment Finishing in March & November
- Color Sciences and Color Measurement in May
- Modern Printing Science in June.
GLOBAL SUPPLY CHAIN MARKETING COMMITTEE

GLOBAL SUPPLY CHAIN MARKETING

Strategic Objective 1: Maintain a global presence for cotton.

An important tactic for maintaining a global presence for cotton is through direct account interaction with mills, manufacturers, brands, and retailers for the apparel, nonwovens, and home products markets. During the second half of 2018, GSCM staff conducted more than 530 meetings with companies in both the manufacturing supply chain and with key brand and retailer accounts. GSCM staff focus efforts on influencing major brands and retailers through coordination of various Company resources, with the goal of influencing the use of cotton versus other fibers.

Staff participated in several major tradeshows in the second half of the year. In both July and November, staff participated in the Outdoor Retailer Show in Denver, CO. This tradeshow is the largest U.S. tradeshow and premier business event for the outdoor industry. The Outdoor Retailer Markets provide a first look at new designs, materials, and trends throughout the outdoor industry. The Cotton Incorporated booth had a prime location on the main floor. The show provides quality connections with the brands and retailers looking for cotton fabrics, performance technologies, innovations, and sustainability information. The meetings are as much about forming relationships with existing and new brands in this market as they are about showing products. The booth displays had crowds gathered to learn about cotton sustainability, including the Blue Jeans Go Green™ denim insulation, 3D printing utilizing cotton, and biodegradability of synthetics vs cotton in soil and water. Inside the booth, a natural fiber display highlighted new cotton/wool fabrics from the FABRICAST™ collection and garments made to showcase those fabrics. Another durability display included new fabrics with the TOUGH COTTON™ technology finish and fabric developments using durable yam technologies. Presence at the show included Cotton Incorporated’s Chief Sustainability Officer who sat on a panel presentation and presented separately on cotton sustainability, a leading and very important topic in this industry. At the July show, Cotton Incorporated’s Senior Trend Forecaster presented the Active Trend Forecast at the Trend and Design Center, where fabrics were on display for attendees to review.

Staff also participated in the Premiere Vision tradeshow in Paris, France. At the September show, the displays at the booth provided key messaging and examples of cotton’s reduced environmental impact and viability as a raw material with less environmental impact than synthetic fibers. Garments on display highlighted natural fiber blends and minimal processing to emphasize the environmental and natural initiative. Two of Cotton Incorporated’s fashion trend forecasters presented the Seasonal Spring/Summer 2020 forecast for attendees in the booth. International and some U.S.-based brands, retailers, and mills visited the booth and learned about cotton sustainability, technologies, and reviewed the new fabric collections.

Staff attended The Functional Fabric Fair by Performance Days July 24, 2018. This was the first show for The Functional Fabric Fair in New York and was located at the Javits Center.

Mexico City staff was very active during the second half of 2018 either hosting, sponsoring, exhibiting, or attending several industry events. The fifth edition of the Latin American Retailers’ Workshop was hosted in Mexico City, with the aim to educate 65 apparel buyers on cotton products and processing. The two-day program included a combination of hands-on classes and mill tours. Additionally, Mexico City staff participated in two sponsored events, the annual joint Mexican Apparel & Textile Convention and the Latin American Textile Chemistry Congress. The first allowed a speaking opportunity to position U.S. cotton and to present the Cotton LEADS™ program to 175 mill owners and top brand managers. The second opportunity was to present as a keynote speaker; highlighting the U.S. cotton fiber industry’s innovation and sustainability efforts, as well as the micro plastic challenge for synthetic fibers. Finally, the largest textile show in Mexico, Exintex, offered the opportunity to exhibit in a large pavilion dedicated only to cotton, the company’s latest initiatives on product innovation, fashion trends, and sustainability.

Cotton Incorporated staff organized a one-day event in Shenzhen, China that hosted more than 80 representatives from leading Chinese manufacturers and apparel brands/retailers. The event provided a full package of information on cotton related topics and created a platform for apparel brands and retailers to be connected with ten Cotton Incorporated technology suppliers. Suppliers exhibited their adoptions of performance cotton technologies and their latest innovative cotton fabrics.
Cotton Incorporated sponsored the 2018 China Textile Innovation Conference. As part of the sponsorship, the Cotton LEADS\textsuperscript{SM} program, cotton sustainability, and performance cotton technologies were presented to more than 400 senior executives from government bodies, associations, and textile companies.

Cotton Incorporated sponsored the 2018 China International Fabric Design Competition. As a part of this sponsorship, Cotton Incorporated staff participated in judging, press interviews, and the award presentation ceremony. Awards were given for best use of cotton for knit and woven fabrics, which stimulated developments and submission of cotton fabrics and provided promotion opportunities.

Cotton Incorporated staff exhibited at Intertextile Shanghai Apparel Fabrics, Autumn Edition in Shanghai, China. The tradeshow event attracted more than 4,500 exhibitors and 70,000 attendees from 32 countries. The Cotton Incorporated booth theme was “Cotton Does Sustainable Performance” and featured cotton innovations, responsible sourcing, and low impact supply chain solutions.

Cotton Incorporated sponsored the Fashion Summit in Hong Kong for the second consecutive year. The event continued to create interest among the regional textile and garment sectors, attracting more than 2,000 participants. Approximately 50 speakers presented on topics focused on the circular economy and sustainable fashion. As part of the sponsorship, Cotton Incorporated was provided booth space, promotional signage, and the opportunity to distribute marketing materials at the event.

Participation in industry events also included:

- Staff presented on the denim retail market at Hengliang’s 10th Anniversary Ceremony in Jiangyin, China. More than 400 attendees attended the event.
- Staff presented at the second annual China Functional & Technical Textile Symposium in Shanghai, China. More than 120 attendees attended the event.
- Staff attended the China Denim Conference in Guangzhou, China.
- Staff attended ITMA ASI + CITME 2018 in Shanghai, China.
- Staff attended CosmoProf Asia in Hong Kong, which provided updates on the market for non-traditional cotton products.
- Staff attended 2018 SpinEXPO in Shanghai, China.
- Staff visited Chinte TechTextile China Nonwoven Show in Shanghai, China.
- Staff attended Hong Kong Fashion Week. The event attracted more than 15,000 representatives from the textile and garment industry in Asia, with more than 1,300 exhibitors.
- Staff attended Centrestage 2018 in Hong Kong.
- Mexico City staff attended the International Textile Congress in Brazil and the International Alpaca Congress in Peru.

Cooperation with Cotton Council International (CCI):

- Staff attended “Cotton and Apparel Market Updates and How the Industry is Moving ahead with Re-Industrialization” in Hong Kong. CCI was a joint organizer.
- Staff attended Cotton Day events in Thailand and Bangladesh.

In its fifth full year, the Cotton LEADS\textsuperscript{SM} program continues to gain momentum as a platform for communicating information about responsible U.S. cotton production to retailers, brands, manufacturers, and industry organizations worldwide. Cotton Incorporated participates in this program with the National Cotton Council of America, the Cotton Foundation, Cotton Australia, and Cotton Council International. In 2018, 57 new partners joined the program, thus reaching a total of 560 partnering manufacturers, brands, and retailers.

In Latin America, there were 11 new Cotton LEADS\textsuperscript{SM} partners and a project was initiated with one of them to have the Cotton LEADS\textsuperscript{SM} logo used on a million pairs of jeans made with U.S. cotton.
The trademark licensing program is one of the marketing techniques used by GSCM to raise global visibility for cotton in products. Several notable products were licensed in the second half of 2018:

- A Canadian brand licensed the Seal of Cotton trademark for use on baby blankets, cloths, and apparel.
- A U.S. brand licensed the Seal of Cotton trademark for use on blankets.
- A U.S. brand licensed the Seal of Cotton trademark on socks.
- A U.S. retailer/brand was licensed to use the Cotton LEADS™ trademark.
- Licensed a U.S.-based brand to use the Seal of Cotton trademark on their 100% cotton home textiles.
- A U.S.-based brand was licensed to use the STORM COTTON™ trademark on apparel.
- A U.S company licensed the Seal of Cotton trademark to be used on 100% cotton flannel sheets.
- A leading U.S.-based chain store has adopted the Seal of Cotton trademark for their home products, specifically top of the bed products.
- A tee shirt company will be using the Seal of Cotton trademark on their men’s, women’s, and children’s private label and licensed tee shirts.
- A Chinese direct sales health group launched 300,000 packs of feminine hygiene pads carrying the Seal of Cotton trademark. Product was distributed in China, Hong Kong, Macau, Singapore, Myanmar, Russia, Indonesia, Bulgaria, and Ukraine.
- A leading Chinese fashion brand adopted the Seal of Cotton & Cotton LEADS™ trademarks on 60,000 hangtags for cotton apparel for the Fall/Winter 2018/2019 season.
- A British nonwoven retailer launched sanitary pads with a 100% cotton top sheet in the Chinese market. The products carried the natural™ trademark.
- Two Korean nonwoven product retailers launched sanitary pads and panty liners with a 100% cotton top sheet carrying the natural™ trademark in the Korean market.
- A Korean nonwoven product manufacturer and retailer launched sanitary pads and panty liners with a 100% cotton top sheet in the Korean market. The products carry the natural™ trademark.
- An Australian beauty product brand launched sanitary pads and panty liners with a 100% cotton top sheet in the Korean market. The products carry the natural™ trademark. The product line has been extended to include facial puffs.
- A Chinese nonwoven brand adopted the Cotton LEADS™ trademark on 100% cotton tissue products. One million packs were launched on one of the most popular Chinese online sites in October and were followed by several million more in November.
- One of the largest Chinese lifestyle brands adopted the Seal of Cotton trademark on 300,000 packs of feminine hygiene pads with a 100% cotton top sheet.
- A Taiwanese nonwoven product manufacturer and retailer extended the use of the natural™ trademark on sanitary pads and panty liners in the Vietnamese markets.
- A Taiwanese paper manufacturer diversified into the cosmetic industry successfully launched 100% cotton facial masks in the Taiwanese markets. The products carry the natural™ trademark.
- Two large Seal of Cotton trademark projects consolidated during the second half of 2018. Both projects, one in Mexico and the other in Colombia, will secure the expansion of the use of the trademark to almost two million cotton-rich garments during 2019.

The GSCM division is responsible for coordinating messaging to the trade. In 2018, consistent messaging and imagery was implemented throughout, including tradeshows, tradeshow promotional items and outlets, and other publications. In addition, new messaging was created for 2018 placement to highlight cotton solutions to the microfiber issue. Trade advertisements were placed in industry publications during the second half of 2018.
**Strategic Objective 2: Promote product and marketing ideas that advance cotton use.**

The GSCM team constantly assess trends in the industry and look for opportunities to play up cotton’s advantages over other fibers where possible. An emerging industry trend, now also becoming an issue consumers are aware of, is the issue of microfiber and micro plastic pollution. The global apparel industry is being cited as a major contributor to this global issue as fibers are shed from textiles and garments during manufacturing and when worn and cared for by the consumer. Synthetic fibers have taken much of the blame as they have been called out by the industry for problems related to bio-accumulation and the inability to biodegrade. Cotton Incorporated staff have seen this as a significant potential opportunity to highlight cotton’s advantage as a biodegradable fiber in soil and water environments. This message is being incorporated into marketing materials and industry facing communications, as well as through direct meetings with clients and was featured at tradeshows, online, and through modest offerings in fabric.

The GSCM team continued work with the Product Development & Implementation Division to develop additional fabrics that can be promoted as alternatives to microfiber fleece. The fabrics were used in men and women’s garments and were displayed at tradeshows and shown in account meetings. Several major brands, who are looking to eliminate microfiber fleece from their products, are reviewing the fabric developments and working with mill partners to commercialize their product lines.

In the second half of 2018, the GSCM division continued the focus on marketing the natural story of cotton and on sustainability in the industry. This information was very timely in response to the issues surrounding micro plastic pollution in oceans and waterways and how supply chain partners are seeking opportunities to reduce their pollution in all environments from raw materials to ways the raw materials or fabric are processed. This natural cotton story was conveyed and displayed at tradeshows, in printed brochures, online, in trade advertisements, and on the CottonWorks™ website. Many brands and retailers have increased interest in this natural and environmental story, with a focus on sustainability.

A major global denim brand based in the U.S. has continued to adopt TransDRY™ technology on denim jeans for the global market. They worked with several Chinese fabric mills for this development. By the end of 2018, there were approximately one million pairs of TransDRY® technology denim produced for this brand. Cotton Incorporated supplied TransDRY® technology hangtags to support promotional efforts, which have a major global presence.

A leading Australia/New Zealand outdoor brand that successfully marketed 30,000 pieces of STORM COTTON™ and Cordura® cotton jackets and shorts expanded their product line to include 190,000 pieces of woven shirts and pants. Marketing assistance was provided on the development of a promotional video and the supplying of 190,000 pieces of STORM COTTON™ technology hangtags. Fabric for these products was sourced from two STORM COTTON™ technology suppliers.

Commercialization of cotton technologies included:

- Staff assisted a major U.S. retailer in their adoption of STORM DENIM™ technology that will be used on denim jeans.
- Staff worked with the Swiss-based arm of an American apparel brand. They will be introducing the STORM COTTON™ technology on a collection of garments sold in Europe and requested assistance with marketing on hangtags.
- The STORM COTTON™ technology was adopted by a major U.S. brand in three styles of men’s 100% cotton sweaters for a Spring 2019 launch. The technology will be promoted by trademark name on product hangtags. Additionally, the STORM COTTON™ technology has been adopted by a U.S. menswear retailer for a ¼ zip jacket to debut in stores in Fall 2019.
- TransDRY® technology is featured in a women’s tank top for an online tennis brand. Additionally, the TransDRY® technology was adopted by a U.S. brand for a men’s polo shirt and men’s tee shirt, both 100% cotton. The shirts will be promoted as having TransDRY® technology and will launch online in spring 2019.
- The TOUGH COTTON™ technology continues to be featured in boys 100% cotton uniform pants for two major brands sold at major retailers. This initial 2016 program continued through 2018.
- There is high-level market interest in the PUREPRESS™ technology. The non-formaldehyde durable press formula provides a solution to a long-term market need and is timely because of the sustainability goals of many apparel brands and retailers. A major retailer, a large private label childrenswear company, and a large apparel company
owning multiple brands have signed confidential disclosure agreements. Trial work is being conducted on bottomweight fabrications on behalf of the large apparel company.

- A new U.S.-based company launched TransDRY® technology on women’s undergarments and are using the trademarked name in the marketing of their products.
- A leading U.S.-based workwear brand introduced a line of men’s performance fleece sweatshirts and pants featuring the STORM COTTON™ technology and staff provided marketing collateral to educate their retail store staff about the performance attributes of the products.
- A leading U.S.-based skate brand continued to grow their STORM COTTON™ technology fleece program this fall. Products are distributed in the U.S. and globally.
- An up and coming U.S. women’s sleepwear brand launched a blend of TransDRY™ technology with antimicrobial technology on sleepwear. The collection includes tops, bottoms, dresses, and jumpsuits.
- A leading U.S.-based activewear company launched a men’s button-down shirt featuring 100% cotton NATURAL STRETCH™ technology for Fall 2018.
- There is continued developmental work for a major activewear brand to adopt TransDRY™ technology for 2020. Asian staff is assisting with trials and implementation.
- A leading U.S. golf apparel brand commercialized 1,500 pieces of SWEAT HIDING™ technology golf shirts. The products were sourced through a Hong Kong sourcing company and will be distributed in the U.S. and the U.K. in Spring/Summer 2019.
- A Chinese casualwear brand commercialized and released 7,400 units of WICKING WINDOWS™ technology tee shirts into the market for their Summer 2018 collection.
- A Chinese children’s wear brand commercialized and released 2,880 units of TransDRY™ technology garments for children for their Summer 2018 season.
- A major Japanese online retailer launched STORM COTTON™ technology golf pants, carrying STORM COTTON™ technology hangtags. Fabric was sourced from a licensed technology supplier in Taiwan.
- An American workwear brand worked with a Taiwanese fabric manufacturer to adopt the STORM COTTON™ technology on hoodies and pants. Products were distributed in the U.S. market.
- A leading outdoor Australia/New Zealand brand worked with a Taiwanese fabric mill to develop STORM COTTON™ and Cordura® technologies on cotton jackets and shorts. Approximately 30,000 pieces were produced and distributed in the U.S., European, and Asia Pacific markets for Spring/Summer 2018.

Adoptions of cotton technologies included:

- A leading textile company in China developed STORM COTTON™ technology knit fabrics for a leading U.S. brand. This brand worked with another Chinese textile company to develop WICKING WINDOWS™ technology knit fabrics for distribution in U.S.
- A leading Chinese textile company continued development of STORM COTTON™ technology woven fabrics for a Chinese casualwear brand. Their initial launch has been very successful.
- A leading Chinese textile company continued development of WICKING WINDOWS™ technology knit fabrics for a Chinese casualwear brand.
- A Chinese textile company adopted STORM COTTON™ technology knit fabrics for the Chinese division of an international sports brand.
- A Hong Kong textile company with production based in China, successfully developed STORM COTTON™ technology knit fabrics for a U.S. sourcing company.
- A Chinese textile company successfully developed STORM COTTON™ technology woven fabrics for a U.S. department store retail chain.
- A leading Chinese textile company developed STORM COTTON™ technology knit fabrics for its U.S. workwear brand customer.
- A Chinese textile company developed TransDRY™ technology knit fabrics for a U.S. casual and underwear brand.
• A leading Chinese textile company adopted WICKING WINDOWS™ technology knit fabrics for a leading U.S. casualwear brand.
• A Chinese textile company successfully developed SWEAT HIDING™ technology knit fabrics for a U.S. global sporting goods company.
• A Taiwanese vertical textile company adopted STORM COTTON™ technology on cotton/Cordura® fleece fabric for a U.S. casualwear brand.
• A Taiwanese denim manufacturer and retailer sourced TransDRY™ technology denim fabric from a licensed supplier in Taiwan to develop TransDRY™ technology jeans for a Japanese brand for distribution in Taiwan.
• A leading U.S. outdoor apparel brand worked with a knit fabric supplier in China to develop WICKING WINDOW™ technology on MVS fabrics for cotton jersey tee shirts.
• A leading U.S.-based outdoor apparel brand worked with a Taiwanese woven fabric supplier to develop STORM COTTON™ technology on men's bottoms. The Fall/Winter 2018/2019 collection will be distributed in Asia Pacific.
• A Hong Kong casualwear brand worked with a Hong Kong knit fabric supplier to develop TransDRY™ technology fabrics for men and women's tee shirts for their 2019 collection.
• A Hong Kong knit fabric supplier reproduced a ruffle knit fabric from the FABRICAST™ collection for a leading U.S. casualwear brand for their men's outerwear collection.
• A textile company in China developed STORM COTTON™ technology knit fabrics for a Hong Kong textile mill, which is a supplier to many international brands.
• A Chinese textile mill developed STORM COTTON™ technology knit fabrics for its Japanese customer for distribution in the Japanese market.
• A leading U.S. casualwear brand worked with two mills with production in China, to develop TOUGH COTTON™ technology knit fabrics. An order was placed with the Chinese mill for bulk production.
• A medium-scale Chinese knit fabric supplier printed fabrics from a Hong Kong mill to develop SWEAT HIDING™ technology fabric for a U.S. golf brand.
• A medium-sized textile company in Japan developed TransDRY™ technology knit fabric using TransDRY™ technology yarn from a Korean yarn supplier. Fabric was marketed to a Japanese golf apparel brand.
• A U.S. golf brand developed STORM COTTON™ technology woven fabrics through a Hong Kong fabric mill. The products will be distributed in the U.S. market.
• A German casualwear brand worked with a major Hong Kong fabric mill to develop STORM COTTON™ technology products for distribution in the European market.
• A Thai fabric mill developed TransDRY™ technology knit fabric for a major Japanese lifestyle brand.
• A Thai brand worked with a Thai fabric mill to develop NATURAL STRETCH™ technology on woven fabric for shirting garments. The products are for distribution in the Thai market.
• A Hong Kong fabric mill developed cotton/wool knit fabric for a U.S. casualwear brand. The specifications were according to samples from the FABRICAST™ collection.
• A leading U.S. casual brand worked with a Hong Kong sourcing company and a knit fabric mill in China to develop STORM COTTON™ technology on men's hoodies.
• A leading U.S. casual brand worked with their current shirtmaking fabric and garment supplier in Hong Kong to develop PUREPRESS™ technology on cotton shirts for their Fall/Winter 2018/2019 collection.
• A leading U.S. mass merchant worked with a knit fabric supplier in China to develop TOUGH COTTON™ technology without resin on girls' leggings for their Fall/Winter 2018/2019 collection.

Technical marketing and technical assistance:
• U.S. staff worked with a well-known handbag/accessory company to develop a fabric combining the STORM COTTON™ and TOUGH COTTON™ technologies.
• At the request of a U.S. brand, staff worked to improve the hand and performance of the SWEAT HIDING™ technology.
- Staff worked with a U.S. women’s apparel brand to implement the TransDRY™ technology into their line and helped to develop hangtags.
- Staff assisted a leading Chinese textile company to develop STORM COTTON™ technology and Cordura® knitted fabrics for their U.S. brand.
- Staff provided technical information to the Japanese division of a U.S. casualwear brand on STAY TRUE COTTON™ technology.
- Staff provided technical information to a Japanese textile manufacturer on TOUGH COTTON™ technology without resin. Development will be for new products for children’s wear for the Japanese market and production will be carried out in their mill in Bangladesh.
- Staff provided technical assistance to a mill in Bangladesh on development of TransDRY™ technology on cotton/Cordura® fabrics, meant for distribution in Japan.
- Staff provided technical assistance to a Hong Kong textile company on development of WICKING WINDOWS™ technology at the request of a U.S. sports brand. The request was to assist with appropriate chemical selection and performance improvement.
- Staff assisted a fabric mill in Bangladesh develop PUREPRESS™ technology on bottom weights at the request of a U.S. brand.
- Staff provided technical assistance to a Pakistani mill to develop TOUGH COTTON™ technology (with and without resin) on bottom weights. The request came from a U.S. retailer, which previously sourced fabrics from China and was looking for alternatives.
- Staff assisted a Hong Kong textile company to reproduce a ruffle knit development from the FABRICAST™ collection for a U.S. retailer. The order would be for Fall/Winter 2019.
- Staff assisted a large-scale Chinese yarn-dyed shirting fabric supplier to adopt PUREPRESS™ technology on four shirting fabrics.
- Staff assisted a large-scale Chinese bottom weight fabric supplier to develop TOUGH COTTON™ technology (without resin) and STORM COTTON™ technology on 100% cotton fabric. Development was at the request of a U.S. brand.
- Staff assisted a medium-scale Chinese trading company and a Chinese manufacturer to successfully adopt TOUGH COTTON™ technology, with and without resin.
- Staff provided assistance to a large-scale knit fabric supplier in order to develop TransDRY™ technology fabrics for a Chinese brand.
- Staff provided assistance to a large-scale knitted fabric supplier to perfect the development of WICKING WINDOWS™ technology on cotton fabric for tee shirts.
- Staff assisted a Malaysian vertical textile company to evaluate TransDRY™ technology on fiber. The project was initiated by a U.S. sportswear brand.
- During the second half of 2018, two Peruvian mills completed technical development in order to start supplying garments to U.S. brands with TransDry® and PUREPRESS™ technologies.

Several brands and retailers who have adopted cotton technologies have continued those programs in 2018. One of the largest programs has come from multiple retailers using the TOUGH COTTON™ technology on cotton knits and wovens to increase abrasion-resistance and wear life in their end products. Three large outdoor and lifestyle brands are continuing their STORM COTTON™ technology programs and expanding by introducing new colorways and updated styling. A large denim brand is continuing their TransDRY™ technology program for the second year and volume has nearly doubled since the launch. One outdoor/lifestyle brand is continuing their TransDRY™ technology program in men’s and women’s products for the third year with updated styles and fabrications each season.

The GSCM division continued collaborations with outside organizations in the second half of the year. Partnerships included work with a yarn company to develop cotton fabrics with antimicrobial performance and work continued with one fiber company to blend small amounts of synthetic fibers with cotton for added durability and longer product life. Developments continued with a full-fashion and whole garment knitwear supplier to develop performance knitwear featuring cotton. The staff also collaborated with an influential outdoor brand to develop cotton totes utilizing the brand’s signature print on a Cotton
Incorporated STORM COTTON™ technology fabric. The totes are used at tradeshows and events to promote performance cotton and the brand’s industry recognition. A collection of men & women’s garments utilizing FABRICAST™ collection developments and cotton technologies was developed with a leading garment innovation studio. These garments will be showcased at tradeshows, industry events and brand/retailer meetings.

**Nonwovens Marketing**

Developments in the second half of 2018 advanced the strategy for the year.

- **3D printing and injection molding:** The team advanced cotton in injection molding from product development to commercialization with two products. One company commercialized boxes with tight fitting lids containing 10% cotton. These are sold in the fishing tackle and craft/sewing businesses as well as other target markets. Toothbrushes also containing 10% cotton were launched online in the last couple of months of 2018. Penetration into brick and mortar stores is still to come as specific packaging is still in development. The toothbrush material has been successfully compounded with 30% cotton, but is not yet commercial.

- **Sanitizing wipes:** In the second half of 2018, in conjunction with the USDA and a consultant, a market research project yielded results that showed a high level of interest in the USDA development. Market development work will happen early in 2019. At a European conference in November, contact was made with a product developer in sanitizing solutions based in the U.K. This region does not permit “over dosing” (adding more chemistry to solutions as is done in the U.S.). There is a high level of interest in the USDA work. The potential customer requested follow up in 2019.

Trademark licensing continues to be extremely important for global market expansion for the use of cotton in hygiene products. In the second half of 2018, work in this area spanned the globe. The key markets were baby care, feminine hygiene, and skin care. Companies ranged from global market leaders to small startups. After a strong first half including 14 new licensees, another 12 companies came on board in the second half. Although the market segments were for the most part core markets for cotton in nonwoven products, what was noteworthy for the year were the countries that came on board. In addition to several new licensees in the U.S., staff interacted with companies from Canada, Germany, Norway, U.K., France, Pakistan, Russia, The Czech Republic, India, Australia, UAE, China, Taiwan, and Korea.

In the fall, a major global consumer brand whose largest business is in baby care launched a new line of baby shampoo/wash and lotion, containing tiny particles of cotton. Their TV and online advertising features the value of cotton to the products’ performance. The cotton enhanced™ trademark has a key presence in all their marketing communications, consumer, retail, and institutional. The company’s goal is to be the number one choice for consumers and hospitals for newborns. The U.S., Canada, and India were target countries for 2018. In 2019, product launches are planned for Brazil, U.K., China, Indonesia, Australia, and New Zealand. Social media support was provided in 2018.

A wide variety of activities and channels of communication were developed and implemented in the second half of 2018.

- **Trade Advertising** - Advertising in business publications, in print and online, is very important to spreading the news about how cotton can bring value to core markets and new markets. The divisional image and campaign is proving to be effective. Data on the impact of these advertisements are double to triple the scores from previous campaigns. The flexibility of the basic design elements allows for advertisements that cut across all markets in this division as well as specific advertisements for target markets and applications.

- **Market Research** - In the second half of 2018, baby care market research was undertaken. This global research covered the U.S., Mexico, Brazil, China, India, U.K., Germany, and France. The results and analysis will provide important material for conference talks, brochures, webinars, and social media marketing in 2019.

- **Events** - In the second half of 2018, staff participated in three industry events; two in Europe and one in the U.S.
  - Outlook Europe: This conference was valuable for learning about the trends in Europe that influence market development in the U.S. Three key subjects included EU restrictions on chemistry, developing regulations around single use plastics, and consumer behavior related to products perceived to have a negative impact on the environment.
  - Hygienix: This hygiene-centered conference delved into all aspects of baby care, feminine hygiene, and adult care products from raw materials through technologies to regulations and sustainability. This is always
a good event for scheduling meetings with several companies. Plans for the following year inevitably come from these discussions.

- Go Wipes: Also in Europe, this event is of value for these reasons. The wipes market is plateauing in the developed markets, which leads companies to seek something new and different. Interest in cotton surged in 2018. European companies are particularly interested in cotton as part of the solution to single use plastics. There are many companies in the wipes supply chain to network and meet with at this conference.

- **CottonWorks™ Platform** - In the second half of 2018, another two lectures were developed and launched. This brings the total to 12 lectures on nonwoven markets, technologies, and cotton. Expansion will continue.

- **Social Media** - This platform is an integral part of marketing communications plans and activities. In the second half of the year, social media communications were used to promote CottonWorks™ lectures, new product launches, and company participation in industry events.

**Fashion Marketing**

During the summer of 2018, Fashion Marketing staff completed production of the presentation for the Spring/Summer 2020 season. It was debuted at Premiere Vision in September.

While finishing production of the Spring/Summer 2020 season, staff also started production on the Fall/Winter 2020/2021 season. At the same time, the Denim 2019/2020 presentation was being shown to accounts throughout the U.S. and Latin America, and was presented extensively throughout Asia during the month of July. This trip also included showing the Active 2020/2021 presentation to select accounts.

The Seasonal Spring/Summer 2020 presentation was taken across the U.S., Latin America, and Asia in the second half of the year. Staff continues to conduct presentations in Cotton Incorporated’s New York office and in the New York market. In the second half of 2018, presentations were conducted in various cities in Mexico, France, China, Hong Kong, Korea, Japan, Thailand, as well as numerous cities in the U.S.

There were 13 additional installments of the City Views blog, which came out in the second half of the year. These blog installments covered research and trend ideas from Melbourne, Sydney, Wellington, New York Men’s Fashion Week, The Panorama Show, DUMBO Brooklyn, Malta, Stockholm, New York Fashion Week, Barcelona, Dublin, Prague, and Antwerp.

Fashion Marketing staff did research both locally and abroad. Research was conducted in Prague, Antwerp, Amsterdam, Paris, Malta, Dublin, Stockholm, Barcelona, and Los Angeles.

Staff either directly participated in or attended trade shows such as Premiere Vision, King Pins, and Intertextile Shanghai. In Latin America, Fashion Marketing staff was featured at various workshops, including the large-scale trade show Exintex. At Exintex, the trend presentation was given and, in addition, a curated presentation on “How Trends are Developed” along with a Q&A afterward for the participants.

Fashion Marketing staff continue to serve the Color Association of the United States (CAUS) maintaining a seat on the board for the Women’s, Men’s, Youth, and Active markets. Staff also enjoys and maintains a close relationship with the Product Development department, with both departments working together in an exchange of ideas to create innovative cotton fabrics for clients.

**Strategic Objective 3: Provide technical education and training to support the use of cotton products.**

The GSCM division manages the Importer Support Program (ISP), which provides programs that meet the mission of Cotton Incorporated and specifically benefit the importer segment of the supply chain. The CottonWorks™ platform, previously COTTON UNIVERSITY™, is the main marketing platform of the Global Supply Chain Division and is supported by the ISP program. The CottonWorks™ platform includes technical education workshops, webinars, education for emerging professionals, events such as the farm tours, and numerous other activities to increase the use of cotton in products.
Twenty-two technical education workshops were held in the second half of 2018 with over 800 attendees. These individuals were from major brands and retailers. The purpose of these workshops was to provide detailed technical information and training on relevant topics important for cotton. The table below summarizes the information for those workshops.

<table>
<thead>
<tr>
<th>Workshop (Topic)</th>
<th>Workshop (Location)</th>
<th>#of Companies</th>
<th>#of Attendees</th>
<th>Overall Program</th>
</tr>
</thead>
<tbody>
<tr>
<td>Printing Science &amp; New Technologies</td>
<td>Hong Kong</td>
<td>17</td>
<td>26</td>
<td>4.2</td>
</tr>
<tr>
<td>Garment Wet Processing</td>
<td>Hong Kong</td>
<td>15</td>
<td>24</td>
<td>4.3</td>
</tr>
<tr>
<td>Functional Finishing</td>
<td>Hong Kong</td>
<td>16</td>
<td>26</td>
<td>4.5</td>
</tr>
<tr>
<td>Garment Wet Processing</td>
<td>Shanghai</td>
<td>11</td>
<td>29</td>
<td>4.9</td>
</tr>
<tr>
<td>Functional Finishing</td>
<td>Shanghai</td>
<td>14</td>
<td>33</td>
<td>4.8</td>
</tr>
<tr>
<td>Woven Fabric Structure &amp; Design</td>
<td>Cary</td>
<td>8</td>
<td>12</td>
<td>4.9</td>
</tr>
<tr>
<td>Denim Manufacturing and Garment Finishing</td>
<td>Columbus</td>
<td>3</td>
<td>28</td>
<td>4.9</td>
</tr>
<tr>
<td>Activewear - Performance Finishes</td>
<td>Boston</td>
<td>10</td>
<td>16</td>
<td>4.8</td>
</tr>
<tr>
<td>Denim Manufacturing and Garment Finishing</td>
<td>Minneapolis</td>
<td>6</td>
<td>27</td>
<td>4.6</td>
</tr>
<tr>
<td>Functional Finishing</td>
<td>Minneapolis</td>
<td>7</td>
<td>28</td>
<td>4.1</td>
</tr>
<tr>
<td>Sweater Manufacturing and Design</td>
<td>Cary</td>
<td>9</td>
<td>12</td>
<td>4.9</td>
</tr>
<tr>
<td>Sweater Design</td>
<td>San Francisco</td>
<td>10</td>
<td>30</td>
<td>4.6</td>
</tr>
<tr>
<td>Fabric Analysis - Knits + Wovens</td>
<td>Cary</td>
<td>15</td>
<td>23</td>
<td>4.9</td>
</tr>
<tr>
<td>Modern Printing Science</td>
<td>Milwaukee</td>
<td>6</td>
<td>38</td>
<td>4.7</td>
</tr>
<tr>
<td>Dyeing Science</td>
<td>Milwaukee</td>
<td>5</td>
<td>33</td>
<td>4.7</td>
</tr>
<tr>
<td>Issues in Product Performance</td>
<td>Milwaukee</td>
<td>5</td>
<td>14</td>
<td>4.1</td>
</tr>
<tr>
<td>Denim Manufacturing and Garment Finishing</td>
<td>Cary</td>
<td>13</td>
<td>29</td>
<td>4.8</td>
</tr>
<tr>
<td>Activewear - Performance in Changing Climates</td>
<td>New York</td>
<td>19</td>
<td>39</td>
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</tr>
<tr>
<td>Fabric Analysis - Knits</td>
<td>New York</td>
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<td>4.9</td>
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<tr>
<td>Knitting + Weaving Fundamentals</td>
<td>San Francisco</td>
<td>13</td>
<td>26</td>
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<tr>
<td>Issues in Product Performance</td>
<td>San Francisco</td>
<td>10</td>
<td>28</td>
<td>4.9</td>
</tr>
</tbody>
</table>

The CottonWorks™ website is a marketing tool and educational resource (www.cottonworks.com). It is the leading innovative education and information resource for current and emerging textile industry professionals who are actively seeking connections to cotton. New content, both educational and marketing, continues to be added on a regular basis. In 2018, four new nonwovens courses were added, new content pages on cotton sustainability were added, and the Spanish version of the website was launched. Additionally, hundreds of cotton fabrics from Cotton Incorporated’s FABRICAST™ collection were digitized and added to the updated FABRICAST™ collection page, a new brochure was added for PUREPRESS™ technology, information on sustainable denim processing was expanded, and lists of “Made in the USA” supply chain information were released. In 2018, there were 27,829 registered users, 110,873 sessions, and 686,583 page views.

CottonWorks™ webinars offer a unique way to reach the industry and amplify our message. In the second half of 2018, two webinars were held, bringing the total to five webinars in 2018. Topics this year included biodegradability in soil environments, biodegradability in wastewater environments (a combination of these two topics were translated for Spanish-speaking audiences), advances in sustainable dyeing, and sustainable denim finishing. Webinars reached more than 830 unique
participants from 377 different organizations. Webinars are one of the most successful methods to share information with a large number of industry professionals from the global cotton industry.

In addition to workshops and webinars, GSCM staff implemented a new seminar program that was piloted in 2017. The seminars are more applied in nature with a shorter presentation format followed by one-on-one meetings with instructors to help participants troubleshoot specific technical problems. In the second half of 2018, three seminars were hosted with 90 attendees from 47 companies.

In 2018, a new university education program was launched. This program includes two elements. The first is a grant program to increase cotton in the curriculum among universities nationwide. In 2018, 16 universities received grants. The second is a program to further educate professors teaching sustainability at leading textile programs, “Educate the Educators.” The three-day “Educate the Educators” event was held in June at Cotton Incorporated’s headquarters. Thirteen professors learned the facts about cotton sustainability in a classroom setting and during a farm visit. Feedback from participants during the fall of 2018 showed that many of the concepts taught in the program were being implemented by the professors in their classes.

The Importer Support Program (ISP) Committee identified two areas of focus for the year, sustainability communications and the production of a sustainability conference for 2019. A new Cotton LEADS™ website was launched in early 2018 to improve sustainability communications. In addition, work continues in this area to strengthen our sustainability voice and to share best practices to others. New content was added during the fall of 2018. The ISP program identified a sub-committee to lead the sustainability conference planning effort. The subcommittee and staff have hired an event-planning agency to execute the event, slated for April of 2019. In the second half of 2018, the conference location was selected and keynote speakers and program details were developed.
CONSUMER MARKETING COMMITTEE

ADVERTISING, PUBLIC RELATIONS, STRATEGIC ALLIANCES, AND CORPORATE STRATEGY & PROGRAM METRICS

Strategic Objective: Use advertising, public relations and strategic alliances to build consumer demand and trade awareness for cotton and cotton products as well as use market intelligence to assess opportunities and threats for cotton, influence corporate strategy efforts and leverage program metrics to evaluate and improve tactics for fulfilling Cotton Incorporated’s mission.

Advertising
The second half of 2018 saw the continuation of the Life is Uncomfortable campaign, with two :15 spots (“Tattoo” and “First Day”) running on television and three spots (“Tattoo,” “First Day,” and “Meme”) running online. In the second half of 2018, TV advertising was seen by 63% of women 18-49, 4.0 times. The commercial was also seen by 54% of men 18-49, 2.9 times and 67% of all adults 18+, 3.8 times.

Television
A total of 1,290 television exposures appeared across ABC, The CW, and FOX broadcast networks and 11 cable channels (Freeform, Food Network, HGTV, BET, CMT, Bravo, E!, MTV, TBS, TLC, VH1). Units were scheduled during popular primetime programming such as Empire, The Good Doctor, 911, Star, Station 19, Charmed, A Million Little Things, Riverdale, Love and Hip Hop, Big Bang Theory, Haunted Gingerbread Showdown, Say Yes to the Dress, Real Housewives, and The Little Couple. To extend TV efforts with a younger audience and “cord cutters,” Roku, an internet streaming service, was introduced. The standard video buy delivered 900K impressions with a target market of women 18-34. A “spotlight sponsorship” delivered an additional 3M+ impressions.

Digital Media
The “Life is Uncomfortable” digital campaign launched online in April. The video assets garnered over 80M video plays with an average completion rate of 59.4% YTD (compared to an industry average of 69%). In addition, the campaign drove a click-through rate (CTR) of 1.21% (compared to an industry average of 0.26%). The campaign was promoted through banner advertising and custom content on women’s and men’s fashion, lifestyle and health/wellness websites such as Brit+Co, Popsugar, Refinery29, UrbanDaddy, and Women’s/Men’s Health. The banners launched in May and garnered over 47M impressions and a CTR of 1.66% YTD (compared to an industry average of 0.06 – 0.08%). Examples of custom content include:

- Refinery29’s How Stuff is Made video, featuring the entire dirt-to-shirt story, delivered over 319K video views and over 580 engagements.
- UrbanDaddy’s The Wardrober, a custom-made styling tool, delivered a time spent on-site of 4 minutes (as compared to UrbanDaddy’s benchmark of 2 minutes).

The campaign utilized audio partner Pandora (desktop and app), delivering about 9M impressions, with a CTR of 0.64% (compared to an industry average of 0.06 – 0.08%). In addition to standard banners and video, Pandora drove further audience engagement through custom playlists and sponsored listening.

Other digital tactics, such as targeting online shoppers or location-based targeting, garnered approximately 192M impressions and a CTR of 0.35% YTD (compared to an industry average of 0.06 – 0.08%).

“The Most Powerful Tee” campaign, which promoted the cotton t-shirt as a canvas for self-expression, launched in October and ran until the end of November. Cotton partnered with media company HYPEBEAST and streetwear retailer Opening Ceremony to create limited-edition cotton tees and video/social content. Media promoted the 30 second video to an 18-34 audience with a strong affinity for fashion, streetwear, individuality, and cultural trends. Overall, the campaign delivered 31M+ impressions and 102K clicks. Of the 31M impressions, 24M of those watched the video in its entirety, delivering a video completion rate (VCR) of 80% (11% higher than the goal of 72%). The fourth quarter Ad Tracker data reported that this campaign scored higher on capturing audience attention (significantly higher for females), followed by being relatable and relevant. Fashion Females and younger females were more likely to be more interested in cotton after seeing the video.
To support the Strategic Alliances retail program with Amazon, campaign banners drove traffic to the Amazon cotton collection. Media ran for one month (9/13 – 10/12) and delivered 176M impressions and 1.1M clicks.

Social Media
Paid and organic social media was used to reach and engage with users across platforms such as Facebook, Twitter, Instagram and Pinterest. Thirteen paid social media campaigns garnered more than 225M impressions and over 28M engagements (likes, comments, shares, etc.) YTD. The second half of the year had paid social efforts such as:

- Fall Fashion Campaign: Fashion influencers’ Color Me Courtney, and Damsel in Dior videos garnered over 30.5M Impressions and 8.9M video views.
- Dr. Mike: To amplify PR’s partnership with Dr. Mike, advertising dollars boosted two videos posts from Dr. Mike’s Facebook account (also known as “whitelisting”), delivering 5.9M Impressions and 175K+ video views.
- “Life is Uncomfortable”: Utilizing the campaign videos “Tattoo,” “Meme,” and “First Day” across Facebook, Instagram, and Twitter, this campaign extended the reach of the television campaign, delivering 51.8M impressions and 18.5M+ video views.
- Blue Jeans Go Green™ partnerships: Madewell, Rag & Bone, and J.Crew were all supported via paid social on Facebook and Instagram, reaching over 6.7M unique users and driving awareness for denim recycling. To bolster Madewell’s denim recycling animation, paid social was used on Twitter, driving over 2M video views.
- “The Most Powerful Tee”: Across Facebook, Instagram and Twitter, the social campaign garnered over 21M Impressions, 5.4M video views, and over 7K clicks to HYPEBEAST.com.
- Strategic Alliances’ Amazon Program: The paid social campaign garnered 18.2M impressions and drove over 765K clicks to Cotton’s hub on Amazon.com.

The Department completed a year-long brand ambassadorship with social influencer Jacey Duprie, a.k.a. Damsel in Dior. Her Instagram efforts reached over 535K people and drove 6,500 engagements (likes, comments, shares). Curated cotton shop collections on her blog, Damsel in Dior, received over 4,400 pageviews and drove the sales of over 840 cotton-rich products. A custom video, featuring her family’s farm, delivered over 5.4M video views.

Search Engine Marketing (SEM)
Paid search advertising on Google and Bing continued to drive qualified visitors to TheFabricOfOurLives.com, resulting in over 611K clicks to the site. 268K of these clicks were directly to the Shop Cotton section, resulting in 33K clicks on cotton-rich products to the respective retailers. The top-performing paid search campaign, by click-through-rate (CTR), was Cotton Care.

Keywords and ad copy were refreshed for all paid search campaigns for the following websites: TheFabricOfOurLives.com, BlueJeansGoGreen.org, and CottonToday.com.

TheFabricOfOurLives.com
Visits to the site totaled 1.3M. With about 32 articles written in 2018, Cotton’s blog continued to feature compelling and seasonally-relevant stories, trends, inspiration, and other information content covering a range of topics related to cotton. Thanks to Search Engine Optimizations (SEO) efforts, the time-spent-on-site continued to grow while the bounce rate continued to decline.

TheFabricOfOurLives.com underwent a full site audit for SEO, identifying site-wide and page-level optimizations that increased Cotton’s visibility in organic search results on Google and Bing.

- Technical SEO recommendations from the site audit were implemented on an ongoing basis to increase Cotton’s visibility in organic search results on Google and Bing. Optimizations have decreased homepage load time from 21.7 seconds to 8.5 seconds.
- An SEO Content Gap Analysis was conducted to provide in-depth content, structure, and linking recommendations to increase the website’s relevance within search engines and optimize the site’s user experience.
An SEO Audience Analysis was conducted to explore cross-channel optimizations based on newly discovered audience personas, including potential blog content.

The Shop Cotton section was continually updated with about 50 cotton-rich items per week for women, men and kids in the apparel and home categories, driving over 108,000 clicks to retail sites, with an estimated retail value of $8M. This included product adoptions in the marketplace via Global Supply Chain Marketing, as well as Strategic Alliances’ retail promotions. The top five retailers were Shopbop, Modcloth, Free People, Amazon and Nordstrom.

Production
Production was completed on “The Most Powerful Tee.” The campaign built relevancy for the Cotton brand amongst a trend-setting audience by partnering with niche clothing brand Opening Ceremony and media publisher HYPEBEAST. Opening Ceremony produced and sold custom t-shirts. The campaign was supported through videos of various lengths (1:12, :30, :15, :10, :06), banners, editorial, a website landing page, and social posts from HYPEBEAST. Opening Ceremony also supported the campaign on their website and social properties. An event was held at the Opening Ceremony store in New York City.

Production was completed on a new cottonseed booth, “The Cottonseed Café,” for the World Dairy Expo. An iPad was on-site allowing visitors to sign up for the Cottonseed Newsletter. The Cottonseed Café won an award for Small Booth.

Production was completed on a cotton fields photo/drone shoot. Over 7K images/videos were captured, using different angles and props to highlight the beauty of the cotton plant.

Production was completed on a partnership with four micro-influencers via influencer agency Influence-Central. Cotton messaging appeared on the influencers’ social media pages and blogs. The partnership drove over 7.5M impressions YTD.

Production was completed on a duratran ad for the Cary office that highlighted why fiber ingredients matter.

Trade Media
A total of 14 macro trade print ads ran in the second half of 2018 in industry publication such as Textile Insight, Ecotextile News, Rivet, AATCC, Textile & Apparel Weekly, and China Textile. The macro trade print campaign was complemented by digital banners on websites such as Ecotextile.com, WWD.com, SourcingJournal.com, Homeandtextilestoday.com, and China Textile & Apparel. Messaging included a variety of topics such as sustainability, the Seal of Cotton™, market research (Lifestyle Monitor™), textile innovations (FABRICAST™), and performance technologies.

To further reach thought leaders and supply chain decision makers, Cotton continued with paid campaigns on LinkedIn, promoting content from Cotton Incorporated websites. YTD, the campaign drove over 400K impressions and 4K engagements, and resulted in over 275 new followers. The best performing piece of content was a carousel unit focusing on Cotton Incorporated’s performance technologies, driving to CottonWorks.com.

A total of 15 nonwovens-specific print ads ran in the second half of 2018 in publications such as Nonwovens Industry, Nonwovens Industry China, Nonwovens Report International, Household Care & Personal Wipes, AVR, and Sustainable Nonwovens. The nonwovens print campaign was complemented by digital banner ads on websites such as nonwovens-industry.com, INDA.org, and sustainablenonwovens.net.

A total of 15 cottonseed-specific print ads ran in the second half of 2018 in publications such as Farm & Dairy Magazine, Feedstuffs, Hoard’s Dairyman, and Milk. The cottonseed print campaign was complemented by digital banner ads on websites such as americandairymen.com, dairyherd.com, and progressivedairy.com. Messaging focused on cottonseed’s benefits and price.

Paid search on Google and Bing for Cotton Today delivered over 130K impressions and drove over 10K clicks to CottonToday.com.
Public Relations (PR)
Support of Consumer Programs
Public Relations supported key consumer-facing projects in the second half of 2018, including the Blue Jeans Go Green™ denim recycling program, and ongoing support of advertising campaigns and initiatives.

In support of the Blue Jeans Go Green™ denim recycling program, the department made several posts on the trade-facing social media channels and helped review press releases and material assets. There was increased promotion of the program on social media on America Recycles Day in November, showcasing the recycling process and up-to-date data about the program.

Sustainability
In October, the department partnered with Texas A&M for media outreach on the USDA deregulation of ultra-low gossypol cottonseed. Outreach garnered 274 news items with a potential audience of 440 million.

Also in October, the department partnered with the University of Georgia to release research data showing cottonseed oil helps reduce bad cholesterol, as compared to olive oil. Outreach garnered five trade news items with a potential audience of 550,000.

Public Relations promoted the U.S. Cotton Trust Protocols as part of the CCI Sourcing USA Summit. This resulted in 42 trade news items with a potential audience of 2.6 million.

The department worked with the Sustainability division to develop talking points and quotes for a press release announcing a joint conservation program with Pheasants Forever/Doves Forever.

The department also increased the frequency of social media posts linking to blog posts and material on the Cotton Today (sustainability) website, made more robust by a more aggressive posting calendar.

Active/Activewear
To further the connection between cotton and active apparel, the Public Relations department became a sponsor of a local professional women’s soccer team; an opportunity with national visibility. In addition to corporate logo signage on field, the package includes: Seal of Cotton logoed tee shirts on field staff for every home game; 12 social media videos featuring athletes and tying back to the advertising campaign; a themed Blue Jeans Go Green™ night at the stadium; and the participation of athletes in a Blue Jeans Go Green™-themed Habitat For Humanity build. National exposure comes from three home games broadcast on the Lifetime Television Network, which is also creating a documentary on the team for broadcast in the first quarter of 2019.

Health & Human Hygiene
Through its agency, the Public Relations department identified a popular influencer, Dr. Mikhail Varshavski (Doctor Mike) to promote the connection between cotton and human health and hygiene. The videos, which appeared on the influencer’s popular YouTube channel and on Cotton Incorporated digital properties, presented a medical expert explaining the connection between cotton and a good night’s sleep, as well as the benefits of cotton underwear and overall good health.

On the corporate Facebook page, the videos had a reach of over 10.7K and garnered over 2,300 views. Posts on Twitter garnered over 4K impressions, while posts on LinkedIn garnered over 5K impressions.

Cotton Incorporated Lifestyle Monitor™ Survey
The Lifestyle Monitor™ survey and other data resources within continue to attract interest in the media, as well as the industry. Public Relations continues to work closely with CSPM to promote all the analytical resources of the company, and to integrate these data to support the direction of the company’s cotton-promoting programs.

The Lifestyle Monitor™ articles continue to remain a popular feature in Sourcing Journal and in the denim-centric Rivet (as appropriate), where the articles are frequently the top reads of the week. Some of the most popular articles were about the evolution of streetwear, performance activewear and the outdoors, and Millennials and transparency in the fashion industry.
The department continued its editorial partnership with the Robin Report in 2018 with articles promoting the *Lifestyle Monitor™* survey and other analyses from CSPM, as well as cotton sustainability.

The department organized a Radio Media Tour (RMT) in October to discuss *Lifestyle Monitor™* data about holiday shopping intentions. The RMT had a confirmed 812 airings on both national and syndicated stations and approximately 16,643,637 impressions.

In 2019, the department is looking forward to working even more closely with the CSPM department to create more content that will be more cohesive across departments and channels.

**Social Media**

The department has also focused on organically growing their social media presence (separate from the consumer facing “Discover Cotton” pages). From July 1, 2018, through December 31, 2018, the trade [Facebook page](#) went from 9,246 followers to 10,302. This number of followers may appear small, especially relative to the consumer Facebook page, which has more than one million followers. However, given the smaller size of the trade audience, the number of followers is quite good.

Video and animated posts have continued to perform significantly higher than static image posts. During the third and fourth quarters, videos posted to the Facebook page garnered over 32.1K minutes viewed and 86.3K video views. The top videos during this time were: *Jacey Duprie Farmer’s Day* (174,778 total reach; video posted two times), the *Fundamentals animation* (8,545 reach), and *Fundamentals - Cottonseed* (12,536 total reach; video posted two times).

The department continues to utilize Twitter as a secondary social media tool, and to post frequently on the Company’s LinkedIn page, sharing articles and information pertinent to the cotton, agricultural, and textile industries through press releases, webinars, environmental videos, etc.

The department has become more active on Twitter and LinkedIn. While LinkedIn is still primarily for industry related information, the department has found that posting more consumer-friendly information on the page has been beneficial. Engagement and followers have increased on the page. Public Relations also started working with the Advertising department to create a “Showcase” page for promoting information from [TheFabricOfOurLives.com](#) and the consumer-facing social media pages.

Public Relations is working to make major updates to the Company’s Wikipedia page to help increase SEO search results, a recommendation made by the Advertising department.

**Strategic Alliances**

**Consumer Sustainability Initiative: Blue Jeans Go Green™ Program**

During the second half of the year, two new premium denim brands launched a partnership with the Blue Jeans Go Green™ denim recycling program. From July 1 through August 31, five FRAME stores encouraged customers to recycle denim in-store and offered 20% off the purchase of new denim as an incentive. The program helped increase denim sales and spread program awareness to a new customer base. From July 14 through July 28, select True Religion stores invited customers to recycle their denim and, in turn, receive 10% off select denim styles. As a result of both programs, more than 200 pairs of jeans have been collected for recycling.

Additionally, there were several “repeat” brand and retail partners that chose to activate in-store around the back-to-school or holiday timeframe. Those retailers include Kimes Ranch, ONS, rag & bone, Theisen’s, and Universal Standard. Each retail partner created a unique denim drive that featured custom creative, encouraged denim recycling, and drove incremental sales of new denim.

In addition to collecting denim year-round, Madewell hosted 65 recycling events in select stores and off-site locations. As an added bonus, Madewell held a promotional event in September that offered customers $30 off a new pair of jeans when they recycled. To celebrate America Recycles Day, Madewell created an animated video that highlighted the recycling program and process. Throughout the year Madewell included the Blue Jeans Go Green™ program in podcast, digital promotion, and social posts. In total, Madewell collected more than 193,000 pieces of denim.
Throughout September and October, six participating universities participated in promoting denim recycling and the Blue Jeans Go Green™ program to more than 220,000 students through a coordinated Fall College Program. Each student group was able to get their campus and local communities involved in recycling denim which resulted in a combined collection total of approximately 2,800 pieces of denim.

For the first time, the Blue Jeans Go Green™ program teamed up with Live Nation, a global music and live entertainment company, for a custom sponsorship and activation. During October, the Blue Jeans Go Green™ program was activated on-site at four different musical concert venues across the country. The activation included a dedicated installation speaking to denim recycling, brand ambassadors, influencer attendance, onsite surveys and more. Seven dedicated influencers generated 36 pieces of content for their Instagram handles resulting in 750,000 impressions and 552,000 Story views. Additionally, from the beginning of October through America Recycles Day on November 15, digital banners were distributed across Live Nation’s network of websites delivering over three million impressions. The banners promoted cotton sustainability messaging and the denim recycling program.

During the second half of the year, the mail-in program continued to be a strong collection channel receiving a total of more than 22,000 pieces of denim. The Corporate Responsibility channel remained to be the most significant source of denim to the program. Corporate partners included Abercrombie & Fitch, Cone Denim, Hudson Jeans, Monsanto, Unifirst, Wrangler, and more.

**Strategic and Retail Partnerships**

For the first time this fall, Cotton partnered with Amazon to launch Cotton’s Fashion Delivered Runway Show. The runway show presented ready-to-wear looks for men and women from the catwalk straight to consumer doorsteps during the September 2018 New York Fashion Week, all with just a few clicks. Amid the backdrop of fall’s latest styles, Cotton’s Fashion Delivered Runway Show connected today’s trendsetters with versatile cotton looks that could be purchased via a “watch now, shop now” digital experience.

The runway show came to life at the Angel Orensanz Theater in the Lower East Side of New York City on September 10. Fashion influencer and model, Rocky Barnes, and fashion journalist, model, and presenter, Louise Roe, along with Amazon’s Alexa hosted the show and shared their go-to cotton looks straight from the runway. All the looks featured in the show, as well as an expanded, curated collection of over 400 cotton-rich styles, were available for purchase in a dedicated online shop on Amazon.com through October 11.

The show made history for Cotton and Amazon with the first Fashion Week runway show debut for the partners. The objective of the program was to highlight the latest cotton trends, while promoting the convenience and easy accessibility of purchasing the items straight from the runway on Amazon, making for a great consumer experience. As a result, the program garnered more than 210M impressions and generated an 8 to 1 return on investment.

Just in time for the holiday season, Cotton teamed up with goop, the modern lifestyle brand, to launch The Cotton Shop: a curated collection featuring an assortment of more than 170 styles of women’s apparel and home goods. Consumers could shop the collection online at goop.com or within a dedicated shop-in-shop at goop LAB’s Brentwood retail location from November 29 through December 31.

From December 3 through January 14, national retailer Buckle, and Cotton partnered to promote the Seal of Cotton and cotton benefits on approximately 4,000 styles across the retailer’s various marketing platforms both online and in-store. This integrated, holiday-focused program includes a curated cotton shop on Buckle.com, website branding, dedicated emails, social media promotion, in-store signage, and more.

**Corporate Strategy and Program Metrics (CSPM)**

**Market Intelligence**

This area encompasses ongoing research studies that assist Cotton Incorporated in monitoring the supply chain for changes in cotton use and/or market perceptions.
**Lifestyle Monitor™ Survey**

Recent research results will be used to better understand attitudes toward cotton and competitive fibers, cotton made in the USA, sustainability, performance features, holiday shopping intentions, retail trends, and shopping preferences. In the second half of 2018, subject areas of research in the Lifestyle Monitor™ survey included, but were not limited to:

- **Seeking out Cotton:** The majority of consumers say they look for high cotton content when checking fiber labels.
- **Smart Textiles:** Between 40-50% of consumers say they would be interested in purchasing smart clothing that regulates their body temperature (51%), measures health during exercise (43%), monitors stress (42%), monitors hydration (41%), and monitors heart rate (41%).
- **Holiday Shopping:** Around 3 in 5 holiday shoppers say they plan to buy clothing as a gift this season (56%), followed by toys (39%), and electronics (33%). The majority of those clothing gift givers (52%) say they will be looking for cotton-rich clothing gifts this season.
- **Retail Trends:** Nearly half of consumers (47%) say they own a device with a digital voice assistant, and for those that do, nearly 2 in 5 (38%) have used that digital assistant to purchase a product.
- **The Fabric of Our Lives® campaign:** Over 3 in 5 consumers (61%) have heard the phrase ‘The Fabric of Our Lives®’. Nearly 3 in 4 (72%) consumers who understand what the phrase ‘The Touch, The Feel of Cotton, The Fabric of Our Lives®’ means, say they can relate to it or feel a connection with it.

**Retail Monitor™ Research**

Retail Monitor™ research is used to better understand cotton’s presence at retail as well as the opportunities and challenges for cotton in major adult apparel categories offered at retail in the U.S. Below are highlights from the 2018 results.

- **Womenswear:** Cotton’s share (weight basis) increased in the majority of the following major womenswear categories, knit shirts (+3.0 percentage points), dresses (+1.0 percentage point), and athletic apparel (+0.7 percentage points). Increases in cotton’s share of women’s athletic apparel were driven by increases in women’s athletic bottoms (+0.9 percentage points), while athletic tops declined (-0.4 percentage points).
- **Menswear:** Cotton’s share (weight basis) increased in the majority of the following major menswear categories, athletic apparel (+4.6 percentage points), pants (+1.4 percentage point), and knit shirts (+0.9 percentage points). Increases in cotton’s share of men’s athletic apparel were driven by increases in both men’s athletic tops (+5.1 percentage points) and bottoms (+2.0 percentage points).

**Import Database**

Key highlights from analysis of apparel and home furnishing import data indicate:

- Average product weights have stabilized and even begun to increase slightly. The 10-15% decline in average product weight throughout the late 2000s was a headwind for consumption. That headwind appears to have stopped.
- Cotton’s share was generally stable for apparel in 2017 and into 2018. Cotton’s share of home imports has been flat to slightly higher.
- A sourcing database that tracks imports by country has been set up to monitor the effects of the evolving tariffs situation.

The bale equivalence of cotton imports for apparel and home has generally been stable in 2017 and into 2018.

**Corporate Strategy**

This area involves the analysis and dissemination of the market intelligence that has been collected through both proprietary and secondary research studies. This information is used to drive internal and external strategies.

**Industry Presentations and Meetings**

During the second half of 2018, staff executed just over 80 presentations and meetings on fiber economics and market research with key global industry contacts which included delivering domestic and global market intelligence presentations in China, Hong Kong, India, Mexico, South Korea, Thailand, and the U.S. Key topics included performance features, athleisure,
denim, sustainability, customization, shopping trends, retail and consumer updates, as well as economic outlook presentations which together totaled over 800 attendees.

**Economic Publications**
CSPM staff continually tracks cotton fundamentals and prices throughout the supply chain. Analysis of the cotton market is published and presented in a variety of formats:

- Twelve issues of the *Monthly Economic Letter* were published to inform participants in the cotton supply chain about developments in the cotton market in order to help them make better and more profitable decisions.
- Twelve issues of the *Executive Cotton Update*, which focuses on the U.S. economy and is designed as a tool to inform clients about how changes in the U.S. economy might affect the cotton supply chain, were published.
- Twelve reports about how changes in cotton prices are “passed through” the supply chain were published and distributed.
- Staff provided weekly radio updates on the cotton market. These “Weekly Cotton Market Updates” are posted on the Cotton Board website and distributed to nearly 50 different radio stations across the nation.
- Staff provided weekly television interviews to RFD-TV which garners 11M impressions weekly from viewership of 45M subscribers. An Agricultural Resource Management study revealed that RFD-TV is the number one source of information for farmers and ranchers.

**Market Research Publications & Supply Chain Insights**

- *Global Lifestyle Monitor: Thailand*, *Global Lifestyle Monitor: China*, *Global Lifestyle Monitor: United Kingdom*, *Global Lifestyle Monitor: Italy*, *Global Lifestyle Monitor: Germany*, *Global Lifestyle Monitor: Turkey*, and *Global Lifestyle Monitor: India*. In partnership with Cotton Council International, based on the results of the 2018 *Global Lifestyle Monitor*, seven infographics were created and disseminated to key accounts and retailers and made available on Cotton Incorporated’s website. Key findings show the integration of digital and in-store shopping as well as growth in consumer interest for quality over price.
- *Video insights*. Three animated infographics aim to help brands and retailers gain insights on global consumer issues such as online shopping, denim jeans trends, and extended size consumers. These video insights, based on the 2018 *Global Lifestyle Monitor* and 2018 Global Extended Sizes Survey, were published on the Cotton Incorporated website.
- Holiday Radio Media Tour. In collaboration with Public Relations, radio interviews were recorded to share results from *Lifestyle Monitor™* about holiday shopping. The tour yielded a total of 502 airings around the country and combined impressions of 7.8 million.
- *Lifestyle Monitor™ email*. In collaboration with Public Relations, emails with trending topics from recent *Lifestyle Monitor™* research were disseminated monthly via email to direct traffic to LifestyleMonitor.CottonInc.com.

**Strategic Research and Program Metrics**
The Strategic Research projects enhance knowledge in areas that are critical for cotton opportunities or challenges as well as help measure corporate efforts to support the Company’s mission. The Brand Tracking Survey is an ongoing market research study conducted by CSPM. The Chinese Consumer Survey is an ongoing market research study conducted jointly by Cotton Council International and CSPM. The latest findings from these projects as well as additional results from other strategic research studies such as Intimate Apparel and Extended Size Consumers are provided.

**Plus-Size Research**
CSPM conducted a survey of 1,500 extended sizes clothing consumers in the U.S., Mexico, and China. Highlights from the results include:

- 70% of extended sizes consumers describe finding stylish clothing in their size as a “chore.” They have the most difficulty finding formalwear, swimswear, businesswear, and clothing with performance features in their size.
- 74% of extended sizes consumers prefer clothing made of cotton or cotton blends, rating comfort as the top attribute sought in clothing.
• Consumers report positive changes if stores offered more extended sizes:
  o 52% would enjoy shopping more
  o 49% would shop more often
  o 38% would spend more money on clothing

Intimate Apparel Research
CSPM conducted a survey of intimate apparel purchasing and usage behaviors among 3,800 consumers in the U.S., Mexico, and China in order to assess the importance of cotton in their decision-making process.

Highlights from the results include:
• Cotton plays a crucial role in the consumer’s choice of intimate apparel. Mexican and Chinese consumers are significantly more likely to prefer 100% cotton for their underwear and undershirts compared to other fibers and blends, while U.S. consumers prefer 100% cotton and/or cotton blends equally.
• Globally, men own an average of 13 pairs of underwear and women own 17. Men own an average of 9 undershirts and women own an average of 7 undershirts/camisoles.
• Performance features are more motivating to consumers in China and Mexico than in the U.S. Consumers in Mexico and China are also generally more willing to pay more for performance features than those in the U.S.

Chinese Consumer Survey
Below are highlights from the most recent results:
• Purchase Drivers: When shopping for clothing, the top purchase driver for Chinese consumers is fit (92%), followed by color (87%), style (84%), finish (84%), and fiber content (82%).
• Smart Textiles: Chinese consumers continue to want clothing with special functions. The majority of consumers (50%) say they would be likely to purchase clothing with stress relieving technology, followed by monitoring running/walking distance and time (39%), managing moods/emotions (36%), monitoring heart rate (34%), and charging their electronic devices (34%).
• Home Textiles: Cotton remains the most preferred fiber among Chinese consumers for their home textiles. The majority of Chinese consumers say they prefer their towels (91%), bed sheets (81%), pillow covers (81%), and bedding (66%) be cotton-rich.

Metrics Survey
Below are highlights from the most recent results:
• Overall, 96% of respondents were satisfied with information or services received from Cotton Incorporated.
• Percent who indicated that the Information/Service received was very or somewhat:
  o Informative – 89%
  o Relevant – 88%
  o Useful – 86%
  o Staff was knowledgeable – 98%
• Among those who requested follow-up services, 95% indicated that staff were very/somewhat responsive to any follow-up questions received
**APPENDIX A: MEDIA OUTREACH COVERAGE**

Generating press releases about noteworthy activities and accomplishments, as well as sharing information with the media, remain extremely successful means of securing press coverage. These proactive and reactive communications draw upon the knowledge of in-house experts and the full range of data and analyses generated by the company. The following communications were disseminated in the second half of 2018.

### Trade

<table>
<thead>
<tr>
<th>Date</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>October 16</td>
<td>USDA Approves Edible Cottonseed</td>
</tr>
<tr>
<td>October 31</td>
<td>Cottonseed Oil Cholesterol Study Results</td>
</tr>
<tr>
<td>November 12</td>
<td>U.S. Cotton Trust Protocols</td>
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</tbody>
</table>

### Consumer

<table>
<thead>
<tr>
<th>Date</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>October 10</td>
<td>Radio Media Tour (Holiday Shopping Intentions)</td>
</tr>
<tr>
<td>October 16</td>
<td>USDA Approves Edible Cottonseed</td>
</tr>
<tr>
<td>October 31</td>
<td>Cottonseed Oil Cholesterol Study Results</td>
</tr>
<tr>
<td>November</td>
<td>Holiday Tips outreach including Lifestyle Monitor™ consumer preference data</td>
</tr>
<tr>
<td>November 30</td>
<td>Goop Promotion w/Catt Sadler</td>
</tr>
<tr>
<td>December 19</td>
<td>Today.com; provided expert tips on shrinking garments</td>
</tr>
<tr>
<td>December 20</td>
<td>Well + Good; provided expert tips on denim care</td>
</tr>
</tbody>
</table>

### Print Coverage

The following is a list of some of Cotton Incorporated’s print coverage in the last two quarters of 2018.

- **NC Agriculture Magazine**: Mention of Cotton Incorporated
- **Cotton Grower**: Mention of Cotton Incorporated
- **San Antonio Express**: Mention of Cotton Incorporated
- **High Plains Journal**: Mention of Cotton Incorporated
- **Dallas Morning Herald**: Mention of Cotton Incorporated

### Television and Radio Coverage

The following is a partial list of Cotton Incorporated’s television and radio coverage in the last two quarters of 2018.

<table>
<thead>
<tr>
<th>Station</th>
<th>Affiliate</th>
<th>Market</th>
<th>Topic</th>
</tr>
</thead>
<tbody>
<tr>
<td>WFAA-TV</td>
<td>ABC</td>
<td>Dallas-Fort Worth, TX</td>
<td>Mention of the Blue Jeans Go Green™ program</td>
</tr>
<tr>
<td>Bill Martinez Live</td>
<td></td>
<td>National/Syndicated</td>
<td>RMT – Holiday Shopping Intentions</td>
</tr>
<tr>
<td>CRN Digital Talk</td>
<td></td>
<td>National/Syndicated</td>
<td>RMT – Holiday Shopping Intentions</td>
</tr>
<tr>
<td>Mom Talk Radio</td>
<td></td>
<td>National/Syndicated</td>
<td>RMT – Holiday Shopping Intentions</td>
</tr>
<tr>
<td>WYYZ</td>
<td></td>
<td>Atlanta, GA</td>
<td>RMT – Holiday Shopping Intentions</td>
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<tr>
<td>KCBQ</td>
<td>AM/Salem Communications</td>
<td>San Diego, CA</td>
<td>RMT – Holiday Shopping Intentions</td>
</tr>
<tr>
<td>WMBX</td>
<td>CBS</td>
<td>Pittsburgh, PA</td>
<td>RMT – Holiday Shopping Intentions</td>
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<tr>
<td>KVUE-TV</td>
<td>ABC</td>
<td>Austin, TX</td>
<td>Mention of Blue Jeans Go Green™ program</td>
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<td>WGRZ-TV</td>
<td>NBC</td>
<td>Buffalo, NY</td>
<td>Mention of the Blue Jeans Go Green™ program</td>
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<tr>
<td>WCNC-TV</td>
<td>NBC</td>
<td>Charlotte, NC</td>
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<tr>
<td>KBMT-TV</td>
<td>ABC/NBC</td>
<td>Beaumont, TX</td>
<td>Mention of the Blue Jeans Go Green™ program</td>
</tr>
<tr>
<td>WHAS-TV</td>
<td>ABC</td>
<td>Louisville, KY</td>
<td>Mention of the Blue Jeans Go Green™ program</td>
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</tbody>
</table>
**Internet Coverage**
The following is a partial list of the online mentions of Cotton Incorporated, or its initiatives or programs, in the last two quarters of 2018.

<table>
<thead>
<tr>
<th>Website/Source</th>
<th>Mention of Cotton Incorporated/Blue Jeans Go Green™ program</th>
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</thead>
<tbody>
<tr>
<td>East Carolinian – Online</td>
<td>Mention of Blue Jeans Go Green™ program</td>
</tr>
<tr>
<td>KRQE-TV Online</td>
<td>Mention of Blue Jeans Go Green™ program</td>
</tr>
<tr>
<td>Daily Lobo – Online</td>
<td>Mention of Blue Jeans Go Green™ program</td>
</tr>
<tr>
<td>DeWitt Observer - Online</td>
<td>Mention of Blue Jeans Go Green™ program</td>
</tr>
<tr>
<td>High Plains/Midwest Ag Journal Online</td>
<td>Mention of Cotton Incorporated</td>
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<tr>
<td>Farms.com</td>
<td>Mention of Cotton Incorporated</td>
</tr>
<tr>
<td>Cotton Grower – Online</td>
<td>Mention of Cotton Incorporated</td>
</tr>
<tr>
<td>Business Standard – Online</td>
<td>Mention of Cotton Incorporated</td>
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<tr>
<td>Crossroads Today</td>
<td>Mention of Cotton Incorporated</td>
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<tr>
<td>Houston Chronicle Online</td>
<td>Mention of Cotton Incorporated</td>
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<tr>
<td>San Antonio Express-News Online</td>
<td>Mention of Cotton Incorporated</td>
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<tr>
<td>Agfax.com</td>
<td>Mention of Cotton Incorporated</td>
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<tr>
<td>BNN Bloomberg Online</td>
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<tr>
<td>Yahoo! Espana</td>
<td>Mention of Cotton Incorporated</td>
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<tr>
<td>New Haven Register Online</td>
<td>Mention of Cotton Incorporated</td>
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<tr>
<td>Fortune Online</td>
<td>Mention of Cotton Incorporated</td>
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<tr>
<td>Waco Tribune-Herald Online</td>
<td>Mention of Cotton Incorporated</td>
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<tr>
<td>Omaha World-Herald Online</td>
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<tr>
<td>Minnesota Ag Connection</td>
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<td>Farm Futures Online</td>
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<td>VAMP</td>
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<td>Yahoo News</td>
<td>Mention of Cotton Incorporated</td>
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<tr>
<td>Cotton Farming</td>
<td>Mention of Cotton Incorporated</td>
</tr>
<tr>
<td>The Curvy Fashionista</td>
<td>Mention of the Blue Jeans Go Green™ program</td>
</tr>
<tr>
<td>The Triad Business Journal</td>
<td>Mention of the Blue Jeans Go Green™ program</td>
</tr>
<tr>
<td>MOMfinds</td>
<td>Mention of the Blue Jeans Go Green™ program</td>
</tr>
<tr>
<td>Denimology</td>
<td>Mention of the Blue Jeans Go Green™ program</td>
</tr>
<tr>
<td>AgPro Online</td>
<td>Mention of Cotton Incorporated</td>
</tr>
<tr>
<td>Growing Tennessee</td>
<td>Mention of Cotton Incorporated</td>
</tr>
</tbody>
</table>
The Corporate Administration Division includes Board of Director Services, Human Resources, Corporate Compliance, Office and Facility Services, and Intellectual Property, Contracts and Legal Departments.

The Corporate Finance Division is comprised of Information Technology (IT) and Accounting.

Regional Caucus Meetings were held during July to nominate Board Members to serve on Cotton Incorporated’s Board of Directors. Caucus meetings were held in 13 states and a total of 24 Director and 24 Alternate positions were up for nomination to serve on Cotton Incorporated’s Board.

Cotton Incorporated’s Board of Directors held a meeting August 7-9 in Scottsdale, AZ. This was a joint meeting with the Members and Alternates of the Cotton Board. The key objectives of the meeting were:
- Presentation of 2019 Plan & Budget
- Presentation of Goals and Deliverables
- Nominations for 2019 Governance and Executive Committees

Staff presented the 2019 Proposed Plan, Budget, and Deliverables to the four Operating Committees. The Chairman’s, Executive, Audit, Pension, Governance, and Joint Calendar Committees also met. During the Thursday Business Session, the Board voted to approve the 2019 Plan and Budget, and elected members to the 2019 Governance Committee.

The Board held its Annual Meeting in Charlotte, NC, December 4-6. Elections of Directors and Alternates for three-year terms beginning January 1, 2019, the Executive Committee, Administrative Officers, Standing Committees, and Operating Committees took place. Following are the Board Executive Committee members for 2019:

- Chairman: Bernie Jordan
- Vice Chair: Van Murphy
- Secretary: James Johnson
- Treasurer: Marvin Beyer
- Member-At-Large: Ryan Robbins
- Agricultural Research: Robert Englert
- Consumer Marketing: Herrick Norcross
- Global Supply Chain Marketing: Shane Isbell
- Research & Development: Clint Webb

Other business included: The four Board Operating Committees met and staff presented the accomplishments of the program for 2018. The Board also conducted its 2018 Board Evaluation of Company Performance Survey during this meeting. The Chairman’s, Executive, Audit, Pension, Compensation, and Governance Committees also met.

**COTTON INCORPORATED**
**BUDGET DATA THROUGH DECEMBER 31, 2018**

<table>
<thead>
<tr>
<th>Program Area</th>
<th>Expenditures</th>
<th>Budget</th>
<th>Actual</th>
</tr>
</thead>
<tbody>
<tr>
<td>Agricultural Research</td>
<td>$ 11,256,000</td>
<td>$ 7,001,199</td>
<td></td>
</tr>
<tr>
<td>Research &amp; Development</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Fiber Competition</td>
<td>$ 4,059,000</td>
<td>$ 3,329,020</td>
<td></td>
</tr>
<tr>
<td>Product Development &amp; Implementation</td>
<td>$ 8,826,000</td>
<td>$ 7,915,532</td>
<td></td>
</tr>
<tr>
<td></td>
<td>$ 12,885,000</td>
<td>$ 11,244,552</td>
<td></td>
</tr>
<tr>
<td>Global Supply Chain Marketing</td>
<td>$ 15,583,000</td>
<td>$ 13,894,296</td>
<td></td>
</tr>
<tr>
<td>Consumer Marketing</td>
<td>$ 29,235,000</td>
<td>$ 29,142,989</td>
<td></td>
</tr>
<tr>
<td>Corporate Administration</td>
<td>$ 5,271,000</td>
<td>$ 5,008,523</td>
<td></td>
</tr>
<tr>
<td><strong>TOTAL:</strong></td>
<td>$ 74,230,000</td>
<td>$ 66,291,559</td>
<td></td>
</tr>
</tbody>
</table>
EXPLANATION OF TERMS AND ACTIVITIES

Agricultural Research Committee

**Cottonseed Marketing** – The objective of this activity is to increase the value of cottonseed at the grower level through strategic, targeted marketing using print and radio advertising, trade shows, direct mail, and publicity (press releases and feature articles).

**Cottonseed Research** – The objective of this research is to eliminate the barriers to cottonseed usage. Activities include research to eliminate gossypol; test the cottonseed nutrient profile to determine natural variation in germplasm, and evaluate this germplasm for adding value and reducing input potential; and develop new products and utilize advances with low-gossypol cottonseed products.

**Disease Management** – The minimization of plant pathogens as significant economically damaging pests in cotton production.

**Host Plant Resistance to Nematodes** – Using Bacterial Artificial Chromosomes (BACs), this activity will attempt to define a gene-rich region on chromosome 11, genetically map it in detail, and ultimately clone the genes to use as genetic markers for directing cotton breeding efforts. The area evidences an apparent cluster of disease-resistance genes, including those conferring resistance to root knot nematode and Fusarium wilt, caused by Fusarium oxysporum race 1.

**Insect Pest Management** – The objectives of this activity are twofold: (1) Develop management recommendations for insect pests that meet the needs of a changing farm landscape using integrated pest management (IPM) strategies, and (2) Support boll weevil and pink bollworm eradication programs with research and technical expertise.

**Weed Management** – The minimization of weeds as significant economically damaging pests in cotton production.

Research and Development Committee

**Fiber Competition: Fiber Quality**

**Quality Measurements Improvement** – The objective of this activity is to provide better tools, measurement systems, and data analysis techniques to improve quality measurements of cotton fiber, yarn, and fabric.

**Product Evaluation Laboratory** – The objective of this activity is to provide accurate, reliable, and unbiased test data on fiber, yarn, fabric, and products from Cotton Incorporated’s research-to-marketing efforts and breeder initiatives to increase the global demand and use of U.S. upland cotton.

**Fiber Competition: Cotton Management System™ Software**

**Cotton Communicator Software™** – Provides merchants and gins options to create Electronic Data Interchange (EDI) files from three different input file types and uses the data to create EDI files in a format that when sent to cotton mills is easily imported into EFS® System MILLNet™ programs and databases using a third party EDI import program.

**Cotton Management System (CMS)** – The Cotton Management System is a group of related software programs, including legacy applications such as the EFS® MILLNet™ System software, designed to work independently and cooperatively to manage cotton as a raw material and asset. By providing tools to manage most aspects of cotton’s life cycle, CMS seeks to improve the efficiency of cotton flow, increase the efficiency and use of cotton, boost the profitability of cotton, and increase the demand for cotton.

**Cotton Management System (CMS): Software Service and Marketing** – The objective of the service activity is to provide high-quality customer service that is critical to the success of the efforts to increase cotton competitiveness through innovative cotton management software. This is accomplished by providing EFS® System users with the documentation and customer service support that enables them to use the products efficiently. Frequent customer contact builds relationships with existing customers and helps gather feedback on the product to guide product maintenance and new product development. The
objective of the marketing activity is to develop a competitive advantage for cotton by defining potential markets for the EFS® System and researching potential customers for current products in the CMS family. This area communicates EFS® System benefits to potential licensees. By maintaining a high level of customer contact, this group works with all segments of the EFS® System product lifecycle by providing information for the maintenance of established products and developing product requirements for future projects.

Cotton Management System (CMS): Software Development and Maintenance – The objective of this activity is to plan and execute the development of new software products for managing and improving the efficiency of cotton as a raw material, asset, and commodity. The Product Development group services and adapts the existing software products that are in the growth and maturity stages of the product lifecycle.

EFS®-USCROP™ Software – Enables a user to review and analyze crop data using USDA high volume instrument classing information. Recap and Discount Premium reports are enhanced with a host of graphs and charts.

Engineered Fiber Selection® (EFS®) System MILLNet™ Software – Manages a mill’s acquisition and use of USDA high volume instrument-classed cotton. Integrated programs create transparency for the different departments within the mill.

Product Development and Implementation

Dyeing and Finishing Applications Laboratory (DFAL): This laboratory contains both production-scale and lab-scale equipment used for internal projects and for industry implementation trials. The machinery allows the application of dyes on textiles and mechanical and chemical finishes.

FABRICAST™ Collection: This is a collection of knit and woven fabrics used to provide the industry with direction and inspiration for product development. The fabrics also strategically market cotton performance technologies.

Fiber Processing (FP): A team of scientists dedicated to converting cotton fiber efficiently into yarn that will meet industry specifications, provide technical assistance, and develop innovative yarns.

Fiber Processing Laboratory (FPL): This laboratory contains opening, cleaning, carding, and spinning equipment for yarn manufacturing.

Hand: The tactile sensations or impressions, which arise when fabrics are touched, squeezed, rubbed, or otherwise handled.

Home Laundry Test Data (HLTD): Conditions developed by AATCC Committee RA88, Home Laundering Technology, to provide a consistent set of test conditions for all test methods involving home laundering.


ISP Workshops: Technical education workshops that are funded under the Importer Support Program in Cary, NC, and in regional and international locations. Cotton Incorporated technical staff members often serve as instructors for the workshops and are heavily involved in the development of workshop materials.
Leno Weave: Is a weave in which two warp yarns are twisted around the weft yarns to provide a strong yet sheer fabric. The standard warp yarn is paired with a skeleton or ‘doup’ yarn; these twisted warp yarns grip tightly to the weft, which causes the durability of the fabric.

Life Cycle Assessment (LCA): A technique to assess potential environmental impacts associated with all the stages of a product’s life (i.e. from raw material extraction through materials processing, manufacture, distribution, use, repair and maintenance, and disposal or recycling) based on inputs and outputs.

Phase Change Material: A substance with a high heat of fusion which, melting and solidifying at a certain temperature, is capable of storing and releasing large amounts of energy. Heat is absorbed or released when the material changes from solid to liquid and vice versa: thus, PCMs are classified as latent heat storage (LHS) units.

Product Development (PD): A team of dedicated scientists and designers that provide the cotton industry with new, inspirational cotton fabrications, provide technical services, and collaborate with industry partners.


Product Development Laboratory (PDL): This laboratory houses knitting, weaving, and Computer Aided Design and Manufacturing equipment for producing fabric samples.

Product Integrity (PI): The department within PDI that is responsible for gathering information on standards and regulations that affect cotton’s market share, for assessing sustainability using life cycle metrics, for liaison with other divisions on matters related to cotton product sustainability and for safety compliance, including the Chemical Hygiene Officer, to ensure a safe working environment for the researchers.

Research and Technical Center: Cotton Incorporated’s research center is located in Cary, NC. For the activities covered in the Research and Development Committee, annual funding for operating the research center is allocated to include expenses for machinery, chemicals, contract labor, and materials.

Technical Services and Implementation (TSI): The department within PDI that is responsible for assisting global mill partners with the implementation of new technologies and maintaining quality production of those technologies, providing technical services, and supporting the marketing efforts of those technologies.

Textile Chemistry Research (TCR): Textile Chemistry Research is comprised of a team of researchers who investigate methods of cotton wet-processing improvement, sustainable wet-processing techniques, and who evaluate new dyes, chemicals, and application methods to enhance the performance and reduce the environmental footprint of cotton.

Global Supply Chain Marketing Committee

Global Supply Chain Marketing

Cotton Council International (CCI) – CCI is responsible for the international promotion of U.S. cotton primarily, but not exclusively, through the COTTON USA Mark program. The majority of CCI’s promotion funds are from the USDA’s Market Access Program, which is administered by the Foreign Agricultural Service. Cotton Incorporated is the largest private contributor to CCI, and these private funds are leveraged an estimated two to four times the amount of government funds. Cotton Incorporated staff work closely with CCI to ensure that the funded programs are complementary to the international activities. In many cases, CCI’s programs are part of a joint effort with Cotton Incorporated staff.

Cotton Incorporated Sponsored Events – Cotton Incorporated is often the host or primary sponsor of industry trade events.

FABRICAST™ Collection – The FABRICAST™ collection is a collection of knit and woven fabrics used to provide the industry with direction and inspiration for product development.
Global Supply Chain – This refers to the network of companies and organizations involved with the manufacturing, sourcing, development, and retailing of textile products and related products such as chemicals and equipment.

ISP Workshops – These technical education workshops are funded under the Importer Support Program.

Suppliers – For each technology marketed by Cotton Incorporated, part of the marketing strategy often involves identifying and working with manufacturers in the supply chain who can market and provide products to interested retailers, brands, or other companies. Cotton Incorporated works with and through established industry manufacturers to further the company’s marketing ability and reach.

Tradeshows – This term refers to industry events that often involve formal conference programs as well as exhibit and booth space. Examples of some of the more prominent tradeshows include Outdoor Retailer, Shanghai Intertextile, and Premiere Vision.

**Consumer Marketing Committee**

Advertising, Public Relations, and Strategic Alliances, and Corporate Strategy & Program Metrics

Chinese Consumer Survey – The Chinese Consumer Survey is an ongoing consumer survey in China that has been conducted quarterly since the third quarter of 2009 and is conducted jointly with Cotton Council International (CCI). Each year, the survey interviews 4,000 Chinese consumers between the ages of 15-54 who are primary shoppers for clothing in over 20 provinces and over 40 cities through random doorstep, face-to-face interviews. Results from the survey are representative of the urban Chinese clothing shopping population. The data are used both internally and externally for publications, presentations, and for strategic direction.

Click Through Rate (CTR) – CTR is a way of measuring the success of an online advertising campaign for a particular website. The click through rate of an advertisement is defined as the number of clicks on an ad divided by the number of times the ad is shown (impressions), expressed as a percentage. For example, if a banner ad is delivered 100 times (100 impressions) and receives one click, then the click through rate for the advertisement would be 1%.

Executive Cotton Update – The Executive Cotton Update is focused on the U.S. economy and is designed as a tool to inform clients about how changes in the U.S. economy might affect the cotton supply chain. Retail sales, clothing store inventories, consumer confidence and spending, and U.S. import data are among the many statistics that are followed in this report.

Lifestyle Monitor™ Survey – The Cotton Incorporated Lifestyle Monitor™ survey is an ongoing consumer survey that has tracked consumers’ product and fiber preferences and shopping habits since 1994. Recent surveys allow for the inclusion of additional questions to analyze specific product-related questions or timely issues such as the economy or holiday spending plans. The data are used both internally and externally for publications, presentations, and for strategic direction.

Monthly Economic Letter – Cotton Incorporated’s Monthly Economic Letter is a regular publication that is released following USDA updates to their supply and demand estimates. This publication is designed to inform participants in the cotton supply chain about developments in the cotton market in order to help them make better and more profitable decisions.

Retail Monitor™ Survey – The Cotton Incorporated Retail Monitor™ survey is a quarterly retail audit of apparel products at 25 major U.S. retailers, in store, and online. The data are used both internally and externally for publications, presentations, and for strategic direction.

Search Engine Optimization (SEO) - Search engine optimization is a methodology of strategies, techniques, and tactics used to increase the amount of visitors to a website by obtaining a high-ranking placement in the search results page of a search engine – including Google, Bing, Yahoo, and other search engines.
Supply Chain Insights – Supply Chain Insights is a publication focused on topics of current interest throughout the cotton supply chain, from fiber production to trade, sourcing and manufacturing, to retail and the consumer. This print publication has also been adapted to include digital video formats as a novel way to engage online audiences.