REPORT OF COTTON INCORPORATED
TO THE SECRETARY'S OFFICE

Mid-Year 2019
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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:

- **Growing cotton demand to 135 million bales by 2028**
  - Cotton product innovation and implementation
  - Cotton sustainability
  - Global presence for cotton

- **Growing U.S. cotton demand and production to 20 million bales by 2028**
  - U.S. cotton sustainability
  - Farm profitability – cost of production
  - Fiber quality / contamination
  - Cottonseed value
  - Cotton Management System: EFS® implementation
  - CCI contribution

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**
  - Agricultural and Environmental Research
  - Sustainability

- **Research and Development Committee**
  - Fiber Competition: Fiber Quality Research
  - Fiber Competition: Cotton Management System (EFS®)
  - Product Development and Implementation (PDI)

- **Global Supply Chain Marketing Committee**
  - Global Supply Chain Marketing
  - Importer Support Program

- **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 2019 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)

The 2019 crop has been one of the most challenging with strong influences beyond farm operators’ control (weather and markets), making the role of AERD and Sustainability even more critical in helping to mitigate risks and improve profitability. Our unique mission is to improve the profitability of U.S. cotton production by improving its market position through strategic sustainability initiatives, funding the creation of agricultural innovations, and driving their adoption by cotton producers.

The strategy employed by AERD to support this mission is to use internal expertise and external research collaborators working as teams to develop innovations, new knowledge, and production tools that impact yield growth, crop value (seed and lint), and production efficiency. We also work to increase the demand for cotton with fiber quality enhancement, coproduct value, and sustainability initiatives. We support the cotton industry’s 10-year sustainability goals and the U.S. Cotton Trust Protocol through the safety net of production efficiency knowledge that is both easy and useful for a diverse set of growers to access. Our research collaborators are almost entirely employed at public institutions where Cotton Incorporated resources are leveraged with other funds to objectively address U.S. cotton’s challenges and opportunities for the direct benefit of producers across a broad geography.

The Sustainability Division has implemented a variety of strategic projects that are aimed at advancing cotton’s position in the marketplace and within the sustainability community. Consumers continue to put pressure on brands and retailers to be more transparent with their supply chains, and cotton has a unique opportunity to take advantage of this market shift. Sustainability funds projects focused on producer enrollment in the U.S. Cotton Trust Protocol. This program will help increase the transparency of the U.S. cotton supply chain, build trust, and lower risk for brands and retailers using U.S. cotton. Additional projects evaluate the environmental performance of using cottonseed oil over more traditional oils and transforming worn blue jeans into home insulation.

In this report, you will read about some of the accomplishments in the first half of 2019. Most of these programs were created long before the devastating planting season and market disruptions as part of the cotton production safety net AERD supports with research and outreach. These accomplishments demonstrate the value of continual investments in modern farming systems. Historically, farming practices were built upon years of experience with the same fields, same varieties, same production tools, and same pests. Now, nothing stays the same, even fields change as growers take on new farms and make land/soil improvements. AERD investments provide the safety net of knowledge about every changing condition: variety selection, pest management, new input evaluations, more efficient use of resources, and investigation/mitigation of potential threats. These focus areas need continual updating and vigilance to avoid profit robbing yield disappointments or expenses.

Areas of significant progress include: adding value to whole cottonseed, cottonseed meal and cottonseed oil; managing the diverse and evolving insect pests of cotton; expanding grower utilization of data in harvesting and ginning; minimizing the threat of plastic contamination in baled cotton; developing breeding tools and germplasm to continually expanding yield; enhancing the reputation of U.S. cotton for sustainability; and launching the pilot phase of the U.S. Cotton Trust Protocol.

Research and Development Committee

Fiber Competition: Fiber Quality Research

Fiber Quality Research has 12 outside research projects for 2019, which consists of the renewal of seven projects and the initiation of five new projects. The top priority for 2019 is dealing with contamination issues. The other key priority is the Fiber of the Future effort, which involves improving fiber length uniformity and fineness.

Product Evaluation Laboratory (PEL) activities continued to focus on normal day-to-day testing. Routine testing on two high volume instrument (HVI®) inter-lab evaluations involved nine proficiency sets, and the lab also provided testing for the USDA-AMS on ten sets of calibration cotton using both HVI® models. A total of three proficiency tests for fabric and one proficiency
test for yarn was also run in the first half of the year. Testing services were active for all areas of research and implementation for both Agricultural and Environmental Research and Product Development and Implementation divisions. The lab has continued to learn and tweak the new version of LogBook® software, a specialized system used by the PEL for all data collection and reporting to meet the lab’s specific needs.

The Cotton Management System (CMS) Product Development team continues to support MILLNet™ software products, with the primary focus on updates and enhancements for the latest version 5.1. The MILLNet™ 5.1 software is being used for all new licensee installations, and conversions of existing users are still ongoing with plans to convert all users by the end of 2019.

The CMS Technical Service and Marketing teams assisted customers 1,653 times by phone, e-mail, text, face-to-face, and the Internet. Yearly service visits were completed for licensees located in China, Colombia, Honduras, Nicaragua, U.S., and Vietnam. Marketing visits were made to prospective clients in Colombia, Guatemala, Mexico, U.S., and Vietnam. Two new MILLNet™ software licenses were signed, and one installation was completed in the first half of 2019.

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

**Product Development and Implementation (PDI)**

Innovation is an essential component of research throughout the Product Development and Implementation Division. Spread across five departments, innovation has strongly focused on yarn, fabric, and finish developments. Novelty yarns were spun using Fiber Processing’s (FP) new Amsler “Wrap Yarn” system to explore technical and commercialization feasibilities. The Product Development (PD) team introduced two FABRICAST™ collections of apparel and home fabrics, which exclusively replenished Marketing’s toolkits. Each collection showcased performance through construction, light weight blends, and natural blends such as cotton with wool. A garment collection focusing on performance plus fashion was created exclusively for the Outdoor Retailer (OR) Show. In other areas, cotton fabrics were blended with nylon fibers containing 3% graphene for thermal performance. To extend Cotton Incorporated technologies, dual technologies were developed combining STORM COTTON™ and TOUGH COTTON™ technologies, as well as TOUGH COTTON™ plus TransDRY® technologies, generating buzz at the OR show and high interest among major brands. Investigation into a 100% cotton fleece continues. To date, a non-formaldehyde flame retardant (FR) system for 100% cotton fleece fabrics was developed. The development provides similar FR properties and has less strength loss than its conventional formaldehyde-containing counterpart has. New product research continued to evolve with the completion of the first prototype of a cotton knitted upper. Exploration incorporating cotton into new markets continues to develop in areas such as injection-molded products and 3D printing.

Sustainability is another key component of internal and outside research for PDI in 2019. Phase two of the microfiber research started early this year in which 100% cotton fabrics finished with different dyes and chemicals were being exposed to the same conditions as in the previous trials. Preliminary results showed that all cotton conditions degrade faster than the oak leaf. The Cotton to Sugar Research continued, with a successfully scaled-up trial. Outside research projects continue to make promising progress. Two key projects are “Processing and Property Evaluation of Nanocellulose Extracted from Cotton Waste” and “Producing Carbon Fiber/Fabric Using End-of-Life Cotton and Application Development.” The PDI division, in particular Product Integrity (PI), also provided direct support to the Sustainability Division by assisting in the life cycle analysis (LCA) of Cotton Incorporated’s denim insulation. To date, PI has also assisted in refining final methodology details of the Sustainable Apparel Coalition’s (SAC) Product Tool.

In conjunction with the Agricultural and Environmental Research (AERD) and Fiber Competition (FC) Divisions, PDI has provided technical support in the Cotton Contamination Challenge. (Please reference AGER section for a cross-divisional update on Contamination.) Product Development and Implementation supported the Cotton Council International (CCI) in investigating traceability technology. Upland cotton fiber, yarn, and fabric samples were produced in two states to be further evaluated for origin. PDI also evaluated blending cotton with raw hemp fiber, all the way from spinning trials through fabric construction. Samples and reports are available to the industry.

Across PDI technical support remains strong; providing guidance to spinning, fabric, dyeing, and finishing mills to expand and improve other Cotton Incorporated technologies. Implementation of the PUREPRESS™ technology continues to progress with numerous trials completed in China, S.E. Asia, Pakistan, India, Mexico, and South America. Support of TOUGH COTTON™ technology remains strong with more mills and brands running trials (largely in S.E. Asia). In May, FP installed new AgTek Multi-
Function winders. The setup and initial testing have been completed and yarns for flat knitting will be evaluated next. The PDI division continues to maintain industry connectivity through the United States Department of Agriculture (USDA) Gin Schools, lab tours, conferences, presentations, company visits, research trips, and trade shows. Two major events being International Textile Machinery Association (ITMA2019), an international textile and manufacturing show held every four years, and Great Ideas in Cotton, a unique conference held in Hong Kong, covering both technology and sustainability updates.

Global Supply Chain Marketing Committee

Global Supply Chain Marketing (GSCM)

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 first half of 2019, GSCM staff conducted more than 325 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.

Global Supply Chain Marketing staff organized and held a one-day event, Great Ideas in Cotton, in Hong Kong on May 22, 2019. Great Ideas in Cotton was an international event showcasing how cotton is transforming the industry through sustainability, fashion, and innovation. The event featured a dynamic conference program, inspiring displays, and an exhibition area comprised of 29 leading manufacturers. The event was attended by over 370 people, from over 180 companies consisting of textile/garment mills, dye houses, fashion brands, retailers, sourcing companies and textile associations, coming from ten countries.

In its sixth year, the Cotton LEADS™ program continues to educate and inform retailers, brands, and manufacturers about responsible U.S. cotton production. Cotton Incorporated participates in this program with the National Cotton Council of America, the Cotton Foundation, Cotton Australia, and Cotton Council International. In 2019, ten new partners joined the program, thus reaching a total of 570 partnering manufacturers, brands, and retailers.

The GSCM division continued collaborations with outside organizations in the first half of the year. Partnerships included continued 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. Two collections of men & women’s garments utilizing FABRICAST™ collection developments and cotton technologies were developed with a leading garment innovation studio.

GSCM worked to secure adoptions of Cotton Incorporated technologies on products, resulting in leading brands and retailers introducing an estimate of more than two million units of product in the market in the first half of 2019. These technology adoptions and product introductions lead to the direct use of cotton fiber and the displacement of competitive synthetic fibers. Commercialization of cotton technologies also included:

- A leading U.S. based work wear brand continued a line of men’s performance fleece sweatshirts and pants featuring the STORM COTTON™ technology. Products are offered in retail stores and on their website.
- The TOUGH COTTON™ technology continues to be featured in school uniform pants and girls’ leggings at a major retailer. This program first launched in 2016.
- A leading U.S. based casualwear brand commercialized 4,500 units of STORM COTTON™ technology sweaters for distribution in the U.S. and Canada for Spring/Summer 2019. They also commercialized around 20,000 units of STORM COTTON™ technology woven pants for men, for Fall/Winter 2019. The woven pants are available in the U.S. and Canada.

The GSCM nonwovens team has worked in the first half of 2019 with some of the largest consumer goods companies in the world. This work has involved coordinating with teams in the U.S. and elsewhere. Some examples include a baby care team working on diapers and wipes in the U.S., a feminine hygiene team in Switzerland, an R&D team working on soaps in Mexico, different R&D and marketing teams in the U.S. working on baby washes, lotions, creams, oils and powders for global markets, a large mass market retailer on a new brand of baby diapers in the U.S., and another global consumer product company marketing feminine hygiene products in Korea.
Twenty-three technical education workshops were held in the first half of 2019 with over 655 attendees. These individuals were from 281 major brands and retailers. The purpose of these workshops was to provide detailed technical information and training on relevant topics important for cotton.

In April, staff hosted the Cotton Sustainability Summit, with more than 60 sustainability decision makers gathered in La Jolla, CA, to learn more about global issues as well as cotton sustainability.

### Consumer Marketing Committee

#### Advertising

In the first half of 2019, The Advertising Department continued the consumer campaign, *Life is Uncomfortable*, with four video assets: *Tattoo, Anchor, First Date*, and *Meme*, targeting women and men 18-49. The campaign honed in on comfort as the key benefit and took a witty and humorous approach to life’s uncomfortable moments.

The 360° campaign aims to reach consumers through TV, video streaming, and digital media, including social media and search engine marketing, driving qualified traffic to Cotton’s consumer website, [www.TheFabricOfOurLives.com](http://www.TheFabricOfOurLives.com).

Cotton continued with Harris Interactive to measure and track campaign awareness and changes in cotton perceptions amongst the target audience. Early indicators can be compared to last year’s benchmarks and inform future campaigns. A research partner was added to the roster this year to measure digital efficiencies and creative effectiveness online.

Advertising completed production on a health and wellness digital campaign consisting of three videos: *Skin Irritation, Underwear*, and *Sheets* as well as launched a competitive *Know Your Clothes* social media campaign to build awareness, educate consumers, and promote the competitive advantages of cotton. Additionally, the Department had an active first quarter in trade media with 37 print ads in circulation focused on a variety of topics including: cotton benefits and sustainability, cottonseed, and textile innovation.

#### Public Relations

Notable among the Public Relations Department accomplishments for the first half of 2019 were activities in support of the sustainability of U.S. cotton, and consumer-facing corporate initiatives such as the Blue Jeans Go Green™ denim recycling program.

During the first and second quarters of 2019, the department secured coverage in atypical and desirable media outlets. Some were a result of an external firm, which provided 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 *Refinery29, Real Simple Online, Martha Stewart Living Online, etc.*

#### Strategic Alliances

The year began with various retail partnerships and Blue Jeans Go Green™ program collection and distribution activities. In addition to Madewell and J. Crew collecting denim for recycling in stores nationwide, other retailers, individuals, and organizations across the country got involved. Additionally, the Strategic Alliances team partnered with Zappos.com and Bed Bath & Beyond to plan and execute programs aiming to drive sales of cotton apparel and home products.

#### Corporate Strategy & Program Metrics (CSPM)

In the first half of 2019, CSPM led efforts to identify opportunities and threats for cotton using market intelligence gathered through ongoing studies of U.S. 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. CSPM provided 80 information requests; participated in 50 meetings and presentations; authored 126 publications, videos, TV/radio segments, and podcasts; and worked on 13 projects.
Work completed by CSPM during the first half of 2019 includes, but is not limited to: the collection and examination of data on more than 70,000 products offered at retail in the U.S. and China; the evaluation of over 6,000 U.S. and 14,000 global consumers; 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 first half of 2019 are provided.
Strategic Objective 1: Increase the short-term profitability of U.S. cotton production.

Cottonseed
The 2019 cottonseed crop is expected to be larger than average and will test the capacity of the dairy industry to consume ever-increasing supplies of cottonseed without a significant reduction in price. Oil mills are running at full capacity, with an ability to process about two million tons per year (about 30% of the crop). The dairy industry is currently experiencing difficult economic conditions, while the U.S. cotton crop is expected to continue to increase. This trend will continue to push the dairy industry to increase the amount they feed dairy cows. Strengthening and expanding the cottonseed marketing efforts in 2019 is well underway. The website, www.wholecottonseed.com is undergoing an overhaul and is updated with current information that encourages expanded use of cottonseed in dairy cow rations. Digital, print, and radio advertising has been increased and the transition of these activities to the Cotton Incorporated Consumer Marketing Committee staff is now complete. Marketing materials for cottonseed oil, starting with collateral, are being created. Ongoing meetings with the oil mill industry continues to set the direction, focus, and activities of this marketing effort.

Precision Cotton
The potential to gain value from the data being recorded by modern machinery, new sensors, unmanned aerial systems (UAS), and satellite images is still emerging. Cotton Incorporated has been sponsoring several projects that will help producers and ginner's capture more value from their data. The first example involves the use of Radio Frequency Identification (RFID) tags to track cotton modules from the field to the gin. John Deere introduced its new round module building cotton harvester over ten years ago and currently round modules comprise the majority of the cotton processed by gins in many regions of the U.S. With such a high level of adoption, the time has come to take advantage of a key feature of those round modules – each one contains four RFID tags and an added external tag that uniquely identifies that module. In 2018, the America Society of Agricultural and Biological Engineers adopted an electronic module numbering standard that extends the use of RFID tags beyond John Deere modules. Cotton Incorporated has funded a demonstration project with the USDA-ARS gin lab in Lubbock, TX, to allow the option to use only the RFID tag to track the cotton from the harvester through the ginning process without adding other tags or spray paint. Additionally, ownership information is only entered once. This project has involved the generation of many software tools that have been developed in an open source environment that are freely available to gins as well as commercial software companies supporting the ginning industry. One of these tools is an Android app in the Google Play store that can be used to scan the code on round modules using the device’s camera or by pairing it with a Bluetooth RFID scanner. eCotton software has also added new features to support the use of RFID tags in 2019. Links to several online resources generated as part of this project have been collected on Cotton Incorporated’s web page at: https://www.cottoninc.com/cotton-production/ag-resources/harvest-systems/RFID-tracking/.

An additional feature of the new cotton harvesters from John Deere is data on every cotton module created by the machine including module weight, area harvested, moisture content, and locations where the module was wrapped and also unloaded from the harvester. In 2019, the department is looking for cotton producers with these capabilities who would be willing to share this data to test the ability to have a “virtual variety trial,” where the module weight and area will be used to calculate a seed cotton yield. Regional university variety trials will be used to estimate a lint turn out value so cotton yields can be estimated, or a producer can report lint turn out values from the gin if available. If successful, this project could greatly increase the data points on how popular cotton varieties perform across multiple soil types, production systems, and environmental conditions.

Work is being conducted to link the quality data on the bale from the gin back to the round module it came from. As more gins begin using RFID tags to track modules from the field to the module feeder, producers will have the ability to generate a fiber quality map of their field. The hypothesis that some of the quality parameters such as mic and length could be calibrated to yield variability in the field is being tested. If yield can be correlated to one or more quality measures, high resolution quality maps would be possible.

As data becomes more valuable to farmers, it is important to make that data easy to capture and manage. AgGateway is a non-profit committed to enabling digital agriculture, and they have facilitated the development of the Agricultural Data Application Programming Toolkit (ADAPT). ADAPT makes it easier for software and hardware from different companies to share data (think
of it as a Rosetta Stone for agricultural data). Once a company connects their system to the ADAPT data model they can then easily receive data from other companies and those companies can receive their data. Cotton Incorporated recently sponsored the development of an ADAPT "plug-in" for cotton classing data so it will be easier for ag software providers to support cotton specific data. We are also exploring how better data communication will make it possible for growers to use data they already have in electronic form to complete sustainability questionnaires, such as the Fieldprint Calculator.

Cotton Incorporated is also in discussions with the National Cotton Ginners Association to see if U.S. cotton ginners may benefit from data standards. Most agricultural equipment manufacturers have adopted Standard ISO 11783 (ISOBUS) to transfer data between tractors and implements. For example, a tractor from one company can plug into the ISOBUS port of a sprayer from another company and the display on the tractor will automatically configure itself to support that sprayer. Such a system could make it easier for cotton ginning equipment to "talk" to each other. There also may be opportunities for gins to anonymously and automatically share data on energy use and ginning rates so they can benchmark their performance against regional averages.

Beyond data, several projects in 2019 are focused on evaluating the use of autonomous robots for weed control and cotton harvest. The early stage design of a robotic cotton harvest system is ultimately envisioned as an attachment to commercial multiple task agricultural robots. Progress continues on the prototype harvesters under development at the University of Georgia and at Clemson University. Weed control functions are being added to both of those systems in 2019. An economic model to estimate the value of frequent harvest is in development that will utilize data on historic weather conditions at harvest by state and hurricane probabilities. Cotton that was hand harvested two times per week in 2018 showed clear fiber quality gains relative to once over harvest at the end of the season. Those hand harvest studies are being repeated at sites in Texas, Tennessee, and Georgia this year to have a robust data set with which to calibrate the economic model. The harvest studies will help us quantify the value frequent harvest brings by reducing risk from complete crop loss due to major weather events such as hurricanes, less aphid and whitefly damage, and better fiber quality by minimizing weathering and reduce cleaning needed at the gin.

Weed Management

Large Plot Variety Evaluation: In 2011 and again in 2015, Cotton Incorporated surveyed cotton growers about their research needs. In both surveys, growers indicated that they wanted an objective, third party evaluation of new cotton cultivars. Before the advent of transgenic cultivars, most conventional cotton cultivars were publicly tested for 2-3 years before their first year of sales. Mass commercial adoption of transgenic cultivars greatly improved heliothine insect control and enabled the use of broad-spectrum post emergence herbicides for weed control, but greatly increased planting seed costs. At the same time, planting seed companies changed their policies regarding public testing of cultivars, and information about the performance of new cultivars prior to their first year of sales greatly decreased. In cooperation with the cotton specialists, Cotton Incorporated runs a Beltwide, Large-Plot Variety Evaluation program. Ten-twelve new cultivars, recommended by the planting seed companies and certain widely grown standards are grown with three replications on 20-25 acre fields. The seed cotton is commercially ginned, and yields and fiber quality are available on the internet in a standard format from Seedmatrix. In 2019, multiple trials are on-going across almost all cotton producing states.

Management of Cereal Rye Cover Crops – Southeast vs. Mid-South: Interest in cover crops has been increasingly slowing over the past decade, in part because their management is compatible with no-till operations and in part because management of glyphosate-resistant Palmer amaranth is improved if early emergence of the weeds, especially pigweeds, can be suppressed by cover crop residues. Grains tend to be easier to establish and tend to be more freeze hardy than are legumes. Substantial effort over the last decade has developed a system of fall planting and spring management of cereal rye in the Southeast Coastal Plain. While the system costs $20-30/acre, it reduces winter soil erosion, improves spring soil moisture holding capacity, and helps with early season weed management. Research in Arkansas and Tennessee is on-going to develop a similar system for the Mid-South where difficulties with fall planting conditions and hard winter freezes are more frequent that in the Southeast. The biomass production goal for the Southeast is 6.0 tons dry matter/acre at roll-down or burn down. This goal is probably too high for the Mid-South, but preliminary evaluations suggest that significant improvement in soil tilth results from cover crop use. An important consideration: when to turn down the rye and how long to wait after turn-down to plant. The longer the crop grows in the spring, the greater the biomass produced; however, allowing the crop to grow into the spring delays planning. Some growers want to plant directly into rolled rye, and some have had success. However, direct planting into green material tends to impede good seed/soil placement and in many instances has created problems with insects attacking emerging cotton seedlings. This year major stand losses have been associated with three-cornered alfalfa hoppers attacking cotton emerging from green cover crops.
Weed Resistance Advances in the Delta

Pre-emergence Combinations: With the decrease in the efficacy of post emergence options for weed control, pre-emergence herbicide use, and the use of pre-mix or tank mix combinations of pre-emergence herbicides at planting have greatly increased over the past five years. Use of at least two herbicides at planting is now common in both cotton and soybeans in the Mid-South. Particularly on Delta soils, both cotton and soybeans use three standard applications (pre, early post plus a residual, and late post) consisting of four or more herbicides, with the effort to use three or more herbicide mechanisms of action to cover the weed spectrum present. Extension agents and consultants are virtually universal in their recommendations of such practices to manage weed resistance.

Resistance to Metolachlor: Use of acetanilide herbicides, such as acetochlor and metolachor, as residual components of the first post emergence treatment has become general in both cotton and soybeans. For many years the acetanilide herbicides (inhibitors of very long chain fatty acid synthesis) were the only herbicide mechanism of action that was not compromised by resistance. This spring, that situation changed. A Palmer amaranth population in Arkansas has been identified that is resistant to metolachlor.

Progressive Loss of Post Emergence Broadleaf Herbicides: Transgenic herbicide-resistant cultivars enable use of broad spectrum herbicides in agronomic crops, and in many cases abetted use of post only systems. After about ten years, post-only systems began failing catastrophically and one by one individual post emergence herbicide mechanisms of action began failing. At the present time ALS, glyphosate, and PPO herbicides are not effective on the great majority of Palmer amaranth populations in the North Delta area. Glufosinate remains effective; however, it is heavily used and often used in combination in other post emergence herbicides. Failure of other post emergence options was a major impetus for the commercial development and broad use of the post emergence auxin herbicides.

Loss of Dicamba Efficacy in West Tennessee: Dicamba has been heavily used in conjunction with the dicamba resistant cultivars. Despite recommendations not to use dicamba-only weed management systems, some growers reputedly have done so. Dicamba has been registered and used for pasture and brush control and used as clean-up treatments in corn and sorghum and for levee treatment in rice. Its general use in cotton and soybeans put further selection pressure on weed populations. Several instances of poor control of dicamba have been observed in Tennessee this year. Weed specialists now warn that one shot of dicamba is not sufficient to manage 3-4 leaf Palmer amaranth. Two applications ten days apart are now recommended.

Need for New Options for Weed Control: Weed management consumes 70% of all pest management costs, a clear demonstration of the critical need for weed control. For the past 70 years, agronomic weed management has been dominated by herbicides. No new herbicide mechanisms of action have been commercialized in the U.S. since 1993, and no new broad-spectrum product has been announced for development for many years. At present every mechanism of herbicide action registered for use in cotton is compromised by weed resistance somewhere, except for fluridone (in terrestrial systems) and glufosinate. In the near-term economic, in-row mechanical weed control will be needed. Such systems are in development for horticultural crops. Available technologies need to be evaluated to determine how they may be adapted and improved for use in cotton agronomic crops.

Target Spot: Target Spot caused by Corynespora cassicoli was first observed in Mississippi about 50 years ago, but was not a serious disease of either cotton or soybean until it was again reported in Georgia in 2009. Since then, it has been a problem chiefly along the Gulf Coast, but also sporadically in the Mid-South, where there was a serious outbreak in 2017. The disease is somewhat difficult to predict and difficult to control. It typically is first observed in late July. It may or may not be serious depending on rainfall. Given a week or more of humid conditions associated with frequent showers it can be explosive and cause up to 70% defoliation in 10-12 days, although usually the effects are slower and milder. All varieties are susceptible but differ in degree of susceptibility. Depending on disease severity, the most tolerant varieties may not be the highest yielding. There were small differences among fungicides but SDHI fungicides were generally more effective. Target spot onset and severity varied among site-years. Except when severity was low, target spot-associated defoliation was greater on the cultivar Phytofen 499 than on Delta & Pineland 1137. Fungicides delayed disease development and defoliation, but the number of applications had little impact. Based on a meta-analysis of 15 site-years, pyraclostrobin-based applications resulted in a 4 to 6% yield savings. Yield savings were higher at site-years with early disease onset and high levels of target spot associated defoliation. Results suggest a single well-timed application of pyraclostrobin-based fungicide reduces defoliation and protects cotton yield at locations with high target spot severity.
**Fusarium oxysporum** f. sp. *vasinfectum* race 4 (FOV4): FOV4 is a significant threat to U.S. cotton production. The disease mechanism of Fusarium wilt is unknown; thus the basis for differential virulence among cotton cultivars and species is unknown and the respective modes of attack of the two races – FOV1, historically the most common in the U.S. and the new, invasive FOV4 are not explained. FOV1, the race formerly considered the exclusive race in the U.S. requires root-knot nematode for infection of cotton. FOV4 may infect cotton independently; thus FOV4 greatly expands the range of locations and soils where Fusarium Wilt can occur. Comparison of the pathogenicity of the respective races reveals significant differences in the mode of infection, etiology, and symptoms. FOV1 is primarily a vascular pathogen. FOV4 is a highly virulent root rotting fungus.

FOV4 was found in the San Joaquin Valley (SJV) in 2004. It is a seed-borne disease. It is now found in all six cotton producing counties in the SJV and is common enough that the California Crop Improvement Association no longer certifies planting seed fields free of its presence. Apparent genetic diversification of the pathogen has transpired since introduction. Three discernable types of FOV4 are now found in the SJV. In addition, one of the SJV types and a second FOV4 type that resembles an FOV7, also a highly virulent Fusarium found in China, are present in the El Paso area. There is considerable danger that FOV4 and/or FOV4,7 will spread in Texas cotton producing areas. A 4-page and a 2-page bulletin on the detection and management of FOV4,7 has been prepared and distributed in Texas and New Mexico.

Invasive Virus in Southeast U.S.: Leaf distortion, stunting of plants, and barrenness of cotton was observed by consultants in the Gulf Coastal areas of Alabama, Florida, Louisiana, and Mississippi in 2017. Since there was a whitefly outbreak in the Southeast in 2017 and the only virus that routinely occurs in the U.S. is the cotton leaf crumple virus in Arizona, it was recommended that an investigation take place. Preliminary analysis revealed the presence of a single-stranded RNA virus that resembles, but is not identical to cotton leafroll dwarf virus (CLRDV), the cause of Cotton Blue Disease in Africa, India, and South America. CLRDV is a polerovirus vectored by cotton aphids. Auburn, Florida, and Mississippi diagnosticians and virologists have identified CLRDV-like virus in seven states – Alabama, Florida, Georgia, Louisiana, Mississippi, South Carolina, and Tennessee. Our understanding of this virus in the U.S. is limited at this time.

**Pest Management**

**Southwest:** Insect pests can be major yield-limiting factors in the production of cotton in the U.S. In the southeastern U.S., major insect pests of cotton include thrips (primarily tobacco thrips, *Frankliniella fusca*), bollworm (*Helicoverpa zea*), and stink bugs (multiple species). Recently, however, plant bugs (primarily tarnished plant bug, *Lygus lineolaris*) have increased in importance, and cotton/melon aphid (*Aphis gossypii*) has been implicated in vectoring a new and potentially costly viral pathogen to the crop. Members of the Southeast Row Crop Entomology Working Group (SERCEWG) involved with entomological research and Extension programming in cotton in the region will continue to work collaboratively to address these issues with the following objectives for the 2019 regional study, participating principle investigators, and an overview of the results.

1. **Survey for incidence of fields meeting or exceeding threshold for the tarnished plant bug, *Lygus lineolaris*, and any other mirids of economic importance in cotton.** Secondary objective will be to associate landscape factors with populations. Surveys will include two major visits to each field – one pre-bloom and one post-bloom visit.

2. **Survey for Cotton leafroll dwarf virus (CLRDV- Blue disease) vectored by cotton aphid, *Aphis gossypii*.** The distribution of CLRDV across the Southeast will be determined by sampling cotton fields from cotton producing counties not surveyed in 2018. The goal of this objective is to identify the current distribution of CLRDV across the Southeast.

3. **Insecticide efficacy trials for cotton aphid, *Aphis gossypii*.** As trial opportunities become available, insecticide efficacy trials for cotton aphid will provide data on potentially slowing of a secondary spread of CLCDV with effective materials. Trials will include all labeled and unlabeled products that provide control of cotton aphid.

4. **Oversprays on 2- and 3-gene Bt cotton for control of bollworm and stink bugs.** Replicated research plots will use WideStrike technology, as it is the weakest Bt technology for control of bollworm. Varieties of 2- and 3-gene cotton from PhytoGen (similar maturities) will be used. Treatments will be tested in two separate trials (2-gene and 3-gene Bt cotton) and applied when the greatest impact will be made, simulating what a producer or consultant would use.

Additionally, tarnished plant bug (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. Cotton is both labor intensive and costly to manage compared to other field crops produced in these states. Many cotton growers face the decision 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, the cotton industries in Virginia and North Carolina 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 2017, 2018, and 2019. The current objectives of this research include: (1) Determine the effects of an IPM approach on pest density, plant injury (e.g., square retention and internal boll injury), lint yield, and economic return; (2) Evaluate thresholds and sampling techniques; (3) Make beat cloths, provide them to growers, and demonstrate how to scout for insect pests.

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 climate change, and a lack of suitable natural enemies. 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 the 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 support a Postdoctoral Researcher to coordinate whitefly research and Extension efforts across South Georgia cropping systems. The post doc is conducting basic research on the host range and annual distribution of whiteflies. These data will catalyze our ability to formulate science-based recommendations and will serve as the basis for development of landscape-wide management plans for whitefly population mitigation.

Mid-South: In 2019, 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 needed 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 bugs, thrips, and cotton bollworm are the three most important pests. Ongoing research is 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. Ongoing evaluations are needed throughout the region to monitor the effectiveness of these two chemicals, as well as to identify 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 the market for several years, and evaluations are needed to verify its continued 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. Field research is needed to evaluate 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 is also necessary.

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 are 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. Determining the impact on 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.

Specific Objectives for 2019 are:

1. **Thrips Control in Cotton.** Insecticide/nematicide combinations as seed treatments or in-furrow applications will be tested at multiple locations in the Mid-South.
2. **Bollworm Control in Cotton.** Field trials will be conducted to evaluate the efficacy of second- and third generation Bt cottons for prevention of injury and yield reduction caused by bollworm and other lepidopteran pests, and to determine the impact of supplemental foliar insecticide applications in these Bt cottons.
3. **Tarnished Plant Bug Control in Cotton.** Insecticides used for control of tarnished plant bugs will be evaluated using a common treatment list and sampling protocol across the Mid-South.

**Southwest.** Profitability/insect control efficacy of seed treatments with an emphasis on thrips and welcoming to other applicable pest measurements appropriate to the region (this is a revision of the seed treatment experiment conducted last year). This was the highest priority of a number of people and showed up as a priority in two regions (the Plains and Gulf Coast/Valley). From an experimental perspective, this is the seed treatment test that would benefit from multiple locations. It is largely a continuation of the last two years of the project that still maintained its high priority. An elevated focus in profitability would increase the value of the data.

In Texas, preventive insecticidal seed treatments are used over 85% of cotton acreage. At an average cost of $10/acre, annual investment into insecticidal seed treatments accounts for greater than $50 million in Texas cotton. For thrips, as an example, seed treatments provide control for up to 2-3 weeks after planting. However, growers in the Plains region may need to put at least one additional foliar insecticide application (e.g. acephate) targeting thrips post-emergence. The major challenges growers face are the lack of preventive insecticidal seed treatments with different modes of action and the lack of research based information on efficacy and economic profitability of different insecticidal seed treatment packages available in the market.

Currently, there is little information available on the efficacy and the economic benefits of various seed treatment packages in cotton to be able to make proper pre-plant decisions. The proposed research will evaluate biological and economic performance of various insecticidal seed treatments against thrips, wireworms, whiteflies and cotton aphid populations on seedling cotton using multi-location field trials.

Profitability/insect control efficacy of cotton cultivars including Bt/non-Bt comparators may vary in susceptibility to worms, plant bugs, and stink bugs. The focus on Bt-tainted cotton, different cultivars varying in susceptibility, or both depends on the region. Some may wish to add an irrigated/dryland contrast. From an experimental perspective, this is a Bt-trait/cultivar test that would benefit from multiple locations and would serve interest in damage and profitability assessment related to worms and plant bugs/stink bugs. It is partly a continuation of the last 2-3 years of the project (cultivar test) that would benefit from the addition of the Bt-trait and conventional cotton contrast.

With increasing incidence of resistance in H. zea to Bt technologies, cotton producers have been forced to rely heavily upon supplemental insecticide applications targeting H. zea to prevent excess economic injury. The insecticides that are the best candidates for managing H. zea in cotton include pyrethroids and the diamide chlorantranpilanolone (Prevathon). There are positives and negatives for both insecticide options. Prevathon is less disruptive of natural enemies and offers good residual control but is expensive. Pyrethroids are very inexpensive but are highly disruptive and short lived. Additionally, resistance to pyrethroids is common in many areas. In Texas, outside of the High Plains, H. zea susceptibility to pyrethroids has not been ascertained in over ten years. It is imperative to determine if pyrethroid resistance is problematic in Texas so growers will be better able to determine which H. zea management options might work best in their production system.

Information gathered from this new project in 2019 will help producers, IPM agents, and crop consultants make sound pest management decisions.

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 continued in 2019 and will utilize RNAi technology to address the problem of a serious pest of cotton, the boll weevil, by transforming and evaluating cotton plants that have been engineered to express RNAi constructs targeting vital boll weevil genes.
**Far West:** For 2019, entomology research efforts in the Far West will primarily focus on lygus and whitefly management. Their efforts will include new and better ways to manage key insect pests at lower cost and greater profitability and envision a near future where PCAs/growers manage beneficials more than pests.

Specific objectives for 2019 are:

1. Develop new rapid and easy to use tools incorporating crucial contribution of biological control by natural enemies. These new tools should provide for even greater reductions in risk and costs.
2. Extensive testing of new active ingredients to arm us with the best chemical controls needed to combat resistant or otherwise difficult to control pest populations and re-secure registrations (e.g., Transform).
3. One-of-a-kind evaluations of new chemistry for safety/selectivity for the beneficial insects present in our cotton system. GOAL: maximize the free biological control services in managing whitefly, Lygus bug and other pests, valued at $37.25 an acre or greater than $220 million in the last 21 years.
4. Explore a new frontier to understand broad patterns of pest and beneficial distributions as they relate to cropping and pesticide use patterns over a region. A new concept will be deployed in proactive resistance management of whiteflies through the deployment of predictive models for resistance.

**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 products. One such project is the completion of the three-year-long human feeding study for cottonseed oil. This research was recently published in a peer reviewed nutrition journal. The results of the study provide 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. The follow-up studies need to be completed before any major promotion campaign can be launched that make claims of health benefits from cottonseed oil consumption. The major findings of the recent study indicate that a rare fatty acid, unique to cottonseed oil, is responsible for the positive effects observed in blood lipids. Efforts are underway to produce greater levels of DHSA for use in a dose titration study. Another study that will support the marketing efforts is a dose titration study that is evaluating increased levels of whole cottonseed in the diets of dairy cows. This will hopefully demonstrate that dairy producers should be feeding higher levels of cottonseed to derive the maximum benefit.

When the USDA announced the deregulation of Ultra-Low Gossypol Cottonseed (ULGCS) in 2018, preparations for commercialization of this transformative technology was put on the fast track. All of the seed available (800 grams) of the most advanced line (Stoneville 474-274) is currently in a seed increase with further expansion planned with use of the winter nursery. This will hopefully produce enough seed for an anticipated planting of at least 500 acres in 2020. Oil mill involvement and participation in processing experiments will be critical in the success of ULGCS. Full deregulation by the FDA is expected to be forthcoming. Initial consultations have been held with COFEPRIS (Mexico's equivalent to the FDA) and efforts to deregulate ULGCS in Mexico will proceed after FDA deregulation has been completed.

Efforts to find a way to mitigate the negative effect of gossypol on cottonseed value can be extensive and time consuming. While research to discover new ways of blocking gossypol production in the seed is ongoing as a minor research effort, research to better understand the antimicrobial properties of gossypol are being studied. Gossypol is known to have a toxic effect on protozoa. A preliminary screening study is underway to evaluate the ability of gossypol to control protozoa in poultry. Protozoa are considered to be a nuisance in ruminant, avian, and aquaculture species. Initial indications look promising.

The brush delinter (in the process of being evaluated for its effectiveness at capturing some of the lost linter value and preparing planting seed) is being continuously updated and upgraded. A new pre-cleaner design is now ready for testing in a commercial setting. A site has been selected and testing should be underway in the next few months.

With an ever-increasing cotton crop and an extension of the ginning season, interest in the technical aspects of cottonseed storage is increasing. Cottonseed storage research has not been recently conducted and there are new seed storage technologies that need to be investigated. A project is underway that will evaluate all that is known about cottonseed storage and identify the gaps in that knowledge that need to be addressed with research.
Variety Improvement

Genomics and Genetics: The team working to develop five reference tetraploid genome sequences submitted a paper to a high impact journal on the five tetraploid species Gossypium hirsutum, Gossypium barbadense, Gossypium mustelinum, Gossypium tomentosum, and Gossypium darwinii. Each sequence is ‘reference grade’ and will likely be the standard cotton researchers utilize in genetic studies globally. We are also well along in assembling three elite public sector variety sequences that will be used to develop a pan-genome for the cotton community. The three varieties include one each from the Universities of Georgia and Arkansas and another from CSIRO in Australia.

Germplasm and Varieties Released: Eight germplasm releases developed by the University of Georgia, each of which includes a Pima fiber quality enhanced segment, have been submitted to the Journal of Plant Registrations (JPR). Another eight germplasm lines developed by North Carolina State University will be published in the next issue of JPR as well.

Cotton Winter Nursery (CWN): Seed from the fourth Costa Rica season was harvested and shipped to U.S. users during the first half of 2019. In May the first ever summer crop was planted to advance populations for use in identifying FOV4 tolerance. Each population will be used in one of the NIFA supported FOV4 proposals as well.

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

Sustainability

U.S. Cotton Trust Protocol: The U.S. Cotton Trust Protocol continued to gain momentum in the first half of 2019. A series of grower feedback meetings have taken place to test the platform. At these meetings, growers completed the best management standards self-assessment for their fields and provided feedback to the U.S. Cotton Trust Protocol team. Additional pilot meetings are planned to solicit feedback from other cotton stakeholders, such as merchandisers, mills, brands, retailers, and NGOs. The pilot release of the U.S. Cotton Trust Protocol online enrollment platform officially launched at the end of June. Both the National Cotton Council and Cotton Incorporated’s Sustainability Division have strategic projects planned to enroll key growers into this program during pilot phase. Full program launch is scheduled for 2020.

West Texas Sustainability Program: In June, a project was initiated to develop and implement a West Texas Sustainability Program in the Lubbock, TX, sourcing region. The main goal of the project is to enroll 50 cotton growers in the U.S. Cotton Trust Protocol and 150,000 representative acres (15,000 measured acres) under Field to Market guidelines. Measured acres will be examined using the Fieldprint Calculator Platform to determine Field to Market’s key performance indicators (KPIs): water quality, land use, soil conservation, soil carbon, irrigation water use, greenhouse gas emissions, and energy use. After the growing season, results will be summarized and discussed with growers to encourage measuring, sharing, and continuously improving cotton productivity, resiliency, profitability, and sustainability.

University of Georgia and Peanut Council: The University of Georgia/Peanut Council’s collaborative research project continued in 2019 with a goal of exploring the environmental benefits of the cotton and peanut rotations using the Fieldprint Calculator. This project has enrolled nearly 50 Georgia growers and 10,000 acres of cotton and peanut rotations into the Fieldprint Calculator platform to date. In 2019, a baseline will be created for Georgia cotton and peanut growers. The baseline Fieldprint Calculator results will be compared to subsequent years’ data to determine relationships between production practices, economics, and sustainability.

Pheasants and Quail Forever Precision Partnership for Working Lands: Cotton Incorporated joined in a partnership with the American Society of Agronomy (ASA) and Pheasants/Quail Forever to win a National Fish and Wildlife Foundation (NFWF) precision conservation grant this past spring. This program officially started in May, a precision agriculture conservation specialist was hired by Pheasants and Quail Forever to lead the program. The specialist is responsible for assisting landowners and their trusted allies, such as Certified Crop Advisers, with farming return on investment (ROI) analyses using precision agriculture data and tools. The ROI analyses will help growers determine if it is cost effective to continue planting in unproductive regions of their fields, or if other options exist that may increase their profitability. Converting unproductive lands to conservation areas will help the U.S. cotton industry meet their sustainability goals, increase grower profitability, and promote wildlife and pollinator biodiversity in and around planted cotton acreage.

Cottonseed Oil LCA: In February, the Sustainability Division started a project to develop a full (cradle-to-grave) comparative LCA to explore the potential reduction in life cycle greenhouse gas (GHG) and other environmental impacts of cottonseed oil
relative to representative mixes of vegetable oils and palm oil. The full comparative LCA will provide information on the environmental benefits of refined cottonseed oil relative to other vegetable oils in the market, identify environmental hotspots in the production process and supply chain, and identify areas of risk. This LCA study will provide Cotton Incorporated and our stakeholders with a better understanding of how cottonseed oil compares with other oils which could be used in marketing purposes aimed at food businesses with GHG emission reduction targets. A screening level LCA was completed in May, with favorable preliminary results showing reductions in climate change (GHG emission) impacts from 20%-90%, depending on which oil was replaced by cottonseed oil. Final results will be available by the end of 2019.

UltraTouch™ LCA: In February the Sustainability Division began the UltraTouch™ Insulation LCA project. This LCA will assess the environmental life cycle benefits of using recycled blue jeans for insulation versus traditional fiberglass insulation. Results from this project will be summarized in a peer reviewed academic publication. This publication will help cotton to further engage in the circular economy discussion. A model has been created to determine impacts from the production process, from waste credential acquisition to final UltraTouch™ product, respectively. Preliminary results from the model show nearly 60% reductions in greenhouse gas emissions by using UltraTouch™ over traditional fiberglass insulation. Final results will be available by the end of 2019.

Turning the Tides: Tackling our Ocean’s Plastic Pollution Problem (CottonWorks™ Webinar): The Sustainability Division collaborated with Global Supply Chain Marketing to host a CottonWorks™ webinar titled, Turning the Tides: Tackling our Ocean’s Plastic Pollution Problem. This webinar, which framed the plastic pollution problem and described how using cotton could help address this growing environmental concern, took place in March and was moderated by Cotton Incorporated’s VP and Chief Sustainability Officer. A deeper dive into this problem was provided by a Senior Sustainability Consultant who discussed their multi-stakeholder Plastic Leak Project (Cotton Incorporated is a project partner). A North Carolina State University professor presented the results from his recent research on microfiber shedding and biodegradability. This webinar helped to frame the global plastic pollution problem through the lens of textiles and provided CottonWorks™ members innovative cotton-based solutions to this growing environmental problem.

ISP Cotton Sustainability Summit: Cotton Incorporated hosted the Cotton Sustainability Summit in La Jolla, CA, in April 2019. The event was a huge success with approximately 116 brand/retail partners attending. The Summit covered a broad range of cotton sustainability topics and also included high-level discussions from experts on climate change and ocean health. Attendee feedback following the Summit was overwhelmingly positive. Another Summit highlight was the session moderated by Cotton Incorporated’s Chief Sustainability Officer, A Foundation for Understanding Cotton, where Cotton Incorporated board members gave the cotton producer side of the sustainability story. Conference attendees also commented that hearing grower testimonials about their sustainability journey was extremely insightful.

Cotton Incorporated Fellowship (CIF) Program
Four new applicants began their courses of study in January 2019. Research topics for the new group of CIFs include cotton leafroll dwarf virus, FOV4, Nested association mapping, and germplasm evaluation.
Addressing the Contamination Threat

Agricultural & Environmental Research, Fiber Competition, and Product Development & Implementation Divisions

There is a clear threat from plastic contamination to the value of U.S. cotton; therefore, there is a multi-divisional strategy to address the threat now in place at Cotton Incorporated. The first part of the strategy is to detect and remove contaminants at both the field level prior to harvest and at the gin during processing. The primary research focus at this time is detection and removal at the gin as that gives the opportunity to remove plastic contamination from both the field and gin. An additional strategy is to explore new materials (ideally cotton-based) to wrap both cotton modules and cotton bales; to support modifying current materials to be detected and/or removed more easily; and to investigate the detection and removal technologies in spinning and nonwoven industries.

Gin Level Detection Efforts: One of the earliest projects to address plastic contamination at the gin was the use of a video camera monitoring the module feeder through a Texas State Support project. In 2018 the National Cotton Council took the lead in deploying several of these systems in U.S. gins to further demonstrate/evaluate the value of this approach and that will continue in 2019. To date, there is consensus that such a system is of value and may be possible with lower cost camera systems.

Another gin-level detection system is an affordable machine vision system deployed on the feeder apron of the gin stand. An initial prototype camera-based detection system was fine-tuned so that 85% of the time it detected and ejected, with a “puff” of compressed air, samples of yellow round module wrap from cotton flowing down a slide simulating the feeder apron on a gin stand. The work resulted in a full-size prototype that Lubbock Gin Lab researchers installed and tested at a commercial gin during the 2018 ginning season. Commercialization of this system is in process in 2019 with two gins selected to have all their gin stands modified. Removal Efforts at the Gin: In addition to the successful air removal system at the feeder apron, past studies at the USDA-ARS gin lab in Stoneville found current cleaning equipment at the gin removes a significant amount of plastic, and they also had some success in adjusting seed cotton cleaning machine settings to remove even more plastic. Follow-up work is continuing at Texas A&M, where the research gin in College Station is being upgraded to have a mini-module feeder to better simulate plastic contamination events. In 2019 a Texas State Support project is focused on the development of an inexpensive way to automate the removal of plastic found at the module feeder.

The Handan GoldenLion Cotton Machinery Company of China sells a contamination cleaner designed to remove foreign matter from seed cotton utilizing three different cleaning sections that remove long strings and large pieces of plastic film; open seed cotton and remove fine trash; and remove small foreign matter/contamination objects by exploiting differences in settling characteristics in an air stream. An 18 bale per hour model of the machine was purchased by Cotton Incorporated and delivered to the Las Cruces Gin Lab in early December of 2018. Installation of the system was completed in April 2019. In initial tests, the machine’s ability to remove round module plastic, plastic mulch, shopping bags, and bale twine will be evaluated. As the main purpose of these tests is to evaluate the potential effectiveness of the GoldenLion machine for use in U.S. cotton gins, significant results from this study will be shared and discussed with researchers at other USDA labs and universities, and with industry collaborators. One possible enhancement to the GoldenLion machine is to add a static charge to the roller at the top of the air chamber to attract plastic as data has shown that cotton has a small positive affinity for static electric charge, while plastics tend to have a large negative affinity. Another project starting in 2019 at the Las Cruces, NM, lab is a test to see if plastic mixed with cotton falling onto heated cylinders will melt and stick to the cylinders. If so, the cylinders can be made to rotate, and the melted plastic scrapped off.

Field Detection Efforts: The primary effort in 2018 and 2019 is detection and removal of plastic at the gin; however, some research is in process to consider field level contamination. For example, a system was developed to collect video of in-field module handling to identify practices that lead to module wrap damage. Video files are still being reviewed for specific illustrative instances of handling practices which were risky, and plans are in place to use the system at several gin yards in 2019 to determine how common damage to the bottom of the module is. Past studies in 2018 did show UAV images could be used to identify plastic bags in the field. Improvements are planned in 2019 for the machine vision system, and those improvements will make the system more useful for field deployment on tractors and mapping plastic in the field at the time of defoliation.
Field Removal Efforts: Work on the robotics weeding and harvest efforts may yield a robot that can collect any plastic in the field while scouting for weeds. In the short-term, the USDA gin lab in Lubbock has worked with students at Texas Tech to develop a system that could “turn off” a row unit if plastic is detected in that row during harvest (not funded by Cotton Incorporated).

Alternative Materials: Some U.S. producers have been attempting to use hay balers to package seed cotton in the field. One challenge to this approach is the contamination potential that is introduced by the baler twine used on those machines. The twine is typically based on a synthetic fiber or sisal, both of which could contaminate cotton if not carefully removed at the gin. Therefore, work is in process to see if a cotton twine can be engineered to meet both the strength and diameter limitations of modern large bale hay machinery. Work is also beginning to examine other materials to better protect traditional and round cotton modules in the field. In addition, technical support is being provided to modify current materials to be more easily detected and/or removed.

Spinning Level Efforts – Work is in progress to investigate the comprehensive and accurate contamination detection and removal technologies in spinning and nonwoven industries.

**RESEARCH AND DEVELOPMENT COMMITTEE**

**FIBER COMPETITION: FIBER QUALITY RESEARCH**

**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  
2019 Objectives: Elucidating the impact of fiber diameter and maturity on fiber breakage.

In 2018, a set of 129 breeder samples had been subjected to laboratory scale mechanical processing to investigate the impact of fiber diameter and maturity on fiber breakage. For 2019 a subset of 20 samples from the original 129 with a diverse range of properties were selected for additional research. These samples will undergo a range of mechanical treatments to assess their potential for fiber breakage during processing. The industrial and laboratory type ginning treatments have been completed with the fiber submitted for HVI® and AFIS testing. The series of lab lint cleaning treatments which include: two different Shirley Analyzers and a microdust trash analyzer (MDTA3) is currently ongoing.

Improving the Utility of Fiber Quality Parameters as a Screening Tool in Breeding Programs  
2019 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.

This 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 processes 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.

The 192 samples harvested in 2018 are undergoing testing, and a total of 432 samples will be replanted in 2019 for further testing. Harvested samples will be used as a subset for spinning trials. For the trash assessment portion of the study, samples have been processed on the Shirley Analyzer. HVI® and AFIS testing were completed in 2018, and the analysis of the impact of mechanical processing on selections is underway and will be included in future reports.

Enhancing the Marketability of U.S. Cotton through Length Uniformity Improvement  
2019 Objectives: Validate the fibrogram calibration method. Validate the new yarn models (with fibrograms) on an independent set of samples. Retrieve the strain-stress curves from the HVI® and determine if this additional information can improve yarn prediction models. Develop a method to improve the ease of fibrogram retrieval and calibration, which will be accomplished by developing software and a database. Investigate the suitability of AFIS length distributions and HVI® fibrogram for improvement of the within sample distribution of fiber length.
In previous years 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. This information appears to be capable of explaining as much information about the variation in yarn quality as information captured by the AFIS length distribution. However, this information showed variation between repetitions of the same sample, indicating that the measurement would need calibration. The calibration protocol previously developed is being tested in 2019 to estimate the stability of the fibrogram. The spread of variation covered by candidate reference bales was determined by translating the fibrograms measured from 72 commercial bales into the calibration domain using principal component coefficients. Long-term stability of fibrograms from these reference bales will be assessed throughout this year. Spinning trials will be done on approximately 50 variable lines to evaluate the use of fibrogram data. The development of a method for automated retrieval of the fibrogram is underway.

Maturity and Standard Fininess: Determination, Calibration, and Use
2019 Objectives: Survey commercial cotton crop to provide recommendations to cotton breeders. Identify commercial candidate bales for calibration cotton production and determine the variability of the standard fineness within varieties of cotton commercially produced in the High Plains of Texas.

Nine levels of maturity and fineness combinations are required for this project out of which five cottons have been identified. A variety with the potential to provide two of the four-missing fineness/maturity combinations was planted in 2018; however, testing results indicate the cotton is too mature to fit the missing fineness/maturity gaps. Further efforts to obtain the needed reference combinations will be limited to an assessment of commercial bales via the ongoing analysis of limited U.S. crop samples from USDA-AMS. That assessment of current U.S. crop quality by AFIS testing completed approximately 2,000 samples thus far this year. Cross-sectional analysis work is ongoing on the currently obtained candidate cotton with two of the five reference bales completed.

Finding Ginning Methods That Improve Fiber Length Uniformity
2019 Objectives: To develop, test, and report on ginning methods that improve fiber length uniformity index.

At the end of 2018, data was analyzed from the New Mexico cotton trials. Results indicated significant differences in the length uniformity from using the experimental lint cleaner connected directly to the gin stand, thereby eliminating the feed mechanism. Roller ginning prevailed; however, when comparing only the saw ginning treatments, the saw gin coupled lint cleaner had longer fiber, better length uniformity, fewer neps, and less lint trash than the saw gin with a conventional lint cleaner. Spinning trials for these samples are underway. Samples from the Stoneville, MS, location have been ginned, and fiber testing will be done in 2019.

Determining Fiber Properties from Full- and Model-Sized Saw and Roller Gin Stands
2019 Objectives: To evaluate the differences in fiber properties, lint percent, and lint turnouts when processed with table-top versus full-size gins spanning a set of nine gin treatments.

This project was started in 2019, and the research will determine the effects of gin treatments on fiber properties tested with HVI® and AFIS. Machine and hand-picked cotton have been acquired for one Pima and two Upland varieties. Refurbishment of the full-size reciprocating knife gin stand needed for this study has been completed. Refurbishment of the feeder for the gin stand has been started.

Dual-beard Fibrography for Cotton Length Distribution Measurement
2019 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.

This project is aimed at developing a portable, economical, and easy-to-use system for fiber length distribution measurement based on dual-beard fibrography and an iterative fiber separation algorithm. The specific tasks that have been completed thus far include: the dual-beard fibrograph protocol, calculation of fiber content at a given length, determination of fiber length distribution, and calculation of length uniformity, mean length, and upper half mean length (UHML). The prototype system is capable of automatically performing sample scanning, fibrograph generation, and length distribution calculation upon manual sample preparation. The researchers are currently working on system improvements and cross-lab/instrumentation validation testing.
Cotton Contamination Detection at Gin Stand Feeder Apron
2019 Objectives: Assess the best method for detecting and removing plastic contamination at the gin-stand feeder apron.

A cut-down version of the plastic contamination-detector-ejection unit that was tested at a commercial gin in 2018 was retested at USDA-ARS Cotton Gin Lab in Lubbock, TX, for efficacy performance. The geometry of the system was set up to match that of the commercial gin unit to achieve commercial scale cotton flows and operation. The latest detection accuracy levels for the system is 92% for opaque pink plastic and 76% for opaque yellow plastic. Development of beta test units to outfit two complete gins is underway with a commercial partner with plans to evaluate the system in two commercial gins for the 2019 ginning season.

Detection of Plastic Contaminants in Cotton Ginning Process Using Near Infrared (NIR) Optoelectronic Technology
2019 Objectives: The objective of this research is to develop an effective and affordable NIR optoelectronic system for detecting and removing plastic contamination at the gin-stand feeder apron.

This is a new project that was started in 2019 to work collaboratively with the scientists developing plastic contamination removal systems at the gin feeder apron in Lubbock, TX. The researchers investigated the options of identifying wavelengths discerning NIR-absorbance of cotton and plastics where peaks specific to cotton can be identified against polyethylene (PE) film and PE twine. The researchers have found two light-emitting diodes (LED) wavelengths suitable for plastic contamination detection, but the LEDs fail to pick up plastic when embedded under thin layers of cotton. The investigators are now moving on to laser detection methods for the remainder of 2019.

Exploring Methods to Extract Plastic Contamination from Cotton (Goldenlion)
2019 Objectives: Evaluate the plastic removal ability of a Chinese manufactured system that was developed to remove various foreign matter from seed cotton, including plastic sheets and strings. Investigate other methods to effectively remove plastic contamination from the cotton flow at the gin.

For this new research project, the machine was delivered to the researchers at the USDA-ARS Cotton Gin Lab in Las Cruces, NM, in December 2018, and installation was completed at the end of April this year. Initial testing indicates that the airflow needs improved efficiency, so the researchers are investigating options for installing a new fan.

Realizing Fiber Quality Insights
2019 Objectives: The objectives of this project involve (1) the development of a robotic system to acquire fiber quality information at the gin; (2) explore the National Cotton Variety Test (NCVT) database to acquire new insights into fiber quality; and (3) determine potential causes of lint color change by simulating storage conditions of raw lint.

Before the start of this new project, a robotic arm was developed and set up to acquire fiber quality measurements in a commercial cotton gin. There are three sensors on the arm to determine color, micronaire, and leaf grade information. The system was utilized to measure over 5,000 bales in the 2018-2019 ginning season, and the data comparison between at gin measured values versus the official HVI® data is underway. The NCVT data has been organized into spreadsheets to start data mining.

Research and Fiber Quality Meetings
Staff participated in a variety of meetings including: Cotton Beltwide Conference; conference calls with laundry industry cooperators, conference calls for National Cotton Council (NCC) USDA Gin School planning, in-house meetings with USDA-ARS-SRRC New Orleans staff including hosting stakeholder meeting, multiple in-house meetings with representatives of different data management and software mapping companies, Bale Packaging Meeting, in-house meeting to evaluate statistical software package, conference call on warehouse storage challenges, NCC USDA Gin Schools in Lubbock and Las Cruces, a visit to Fiber Biopolymer Research Institute to discuss research, a visit to the University of North Texas to discuss research, and hosting laundry cooperator group meeting.

Presentations were made as follows: Gin School lectures included Cotton Quality Issues, Micronaire Issues, Textiles 101, and Textile Industry Trends; and for American Cotton Shippers Association International Cotton School: Working Towards Improved Cotton Fiber Quality.
Strategic Objective 2: Provide accurate test data to support research and marketing efforts.

Product Evaluation Laboratory
The Product Evaluation Lab (PEL) replaced the 20+ year-old weather-ometer, Ci4000, in January. A weather-ometer is an instrument that tests the colorfastness and durability of fabrics and textiles to light exposure, temperature, and humidity. The manufacturer made staff aware in 2018 that this older model would not be serviceable after 2019. The new model, Ci4400, features an increased specimen capacity; has a full-color touch screen user interface display of all test parameters; and can run test methods developed by the American Association of Textile Chemists and Colorists (AATCC), the American Society for Testing and Materials (ASTM), and the International Standards Organization (ISO).

Agricultural and Environmental Research
Testing for Agricultural and Environmental Research was focused on general Agricultural Research initiatives, sustainability, and variety improvement.

Fiber Competition
For fiber testing, the following routine HVI® studies were completed in the first half of the year: six monthly check cotton tests, one Bremen Institute round robin, two Commercial Standardization of Instrument Testing of Cotton (CSITC) round robins and ten USDA-AMS 220 Calibration Sets on two HVI® systems. For fabric testing, three AATCC proficiency studies were completed. For yarn testing, one TestTex yarn proficiency study was completed. Lab staff also provided training on participating in CSITC to an EFS® System 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, combing quality research, 40s compact ring spinning for shirting research, 10s carded open end spinning for 3-end terry, hemp yarn research, and technical service for a potential domestic EFS® System licensee for lay-down and crop change problem solving.
- 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 and Implementation (PDI): PDI initiatives involved work with cationic denim, suede/printed EarthColors® denim, knit-look woven developments, and foiled fabrics.
- 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. TS 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; and TOUGH COTTON™ and PUREPRESS™ technologies.
PEL Testing Summary for 2019 as of June 30:

### Cotton Incorporated Activity Summary Report

**Date Range:** 01/01/19 - 06/30/19  
**Completed Projects**

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23
Staff addressed the need to refresh promotional material by creating new USCROP™ software marketing content to produce a new brochure with plans underway for the development of a short marketing video.

Staff hosted an HVI® Educational Workshop for an EFS® System licensee in Vietnam. Staff from the mill spent two days in Cary before visiting the Memphis Classing Office. The agenda included having the lab team discuss and demonstrate the importance of sample conditioning, instrument calibration, and proper HVI® operation. The attendees were also taught the importance of and how to participate in the CSITC round trials program. This education program also included fiber quality presentations and general EFS® System discussions with those teams. This class is offered to select EFS® System licensees that need encouragement in trusting USDA HVI® data.
The staff gave EFS® System marketing presentations at meetings with prospective mills in Colombia, Guatemala, Mexico, U.S., and Vietnam. The package of software products currently being marketed include:

- EFS® System MILLNet™ 5.1.001 software
- EFS® System MILLNet™ for Merchants 9.0 software
- EFS®-USCROP™ 8.1 software
- Cotton Communicator™ 1.022 software.
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 2019, the Fiber Processing Lab (FPL) has prepared over 500 pounds of yarn to assist with a variety of projects. Most notably, the Fiber Processing (FP) team performed package preparations on seven projects, producing 229 pounds of yarn and developing new fluorescent-free yarns treated with TransDRY® technology. Five projects, producing 251 pounds, were spun using a mixture of doubling, twisting, and back winding to create novel yarns for Product Development (PD) projects. Only one project was completed in support of the Importer Support Program (ISP), resulting in 32 pounds of yarn.

FABRICAST™ Information System – Textile Collections for Marketing Toolkits
The PD team completed two FABRICAST™ collections for apparel and home fabrics in 2019. Updated marketing toolkits, utilized by Global Supply Chain Marketing (GSCM) in their interactions with brands and retailers, also reflect the new collections. The broad theme for 2019 collections encompasses performance cottons via construction, blends, and finishes. The intention behind FABRICAST™ collections is to release new and relevant fabrics to new audiences, to entice more decision makers, retain existing audiences, and to keep the industry involved with inspirational and innovative cotton fabrics. An overview of the various categories with the collection follows. In one overview, the apparel fabrics developed by PD for the Performance plus Fashion collection became garments. These garments served as a main focal point at Cotton Incorporated’s booth during the important Outdoor Retailer Show held in Denver, CO.

- **Performance Through Construction:** Breathable shirting-weight fabrics and sheeting textiles potentially offer performance benefits and were researched through open pore, mock leno, and leno structures, using the in-house Sampling Dobby Loom. Finishing trials to optimize the ventilating structures commenced while additional yarn and construction experimentation continued. Full width weaving, at an outside facility, will follow on the most successful prototype once the optimum structure is determined.
- **Lightweight Performance Blends:** Lightweight performance blends were woven for the active outdoor apparel market. A series of cotton-rich performance textiles, being both technical and soft, in two-sided configurations, were developed. A face-dominant, nylon 6,6 filament warp provided luster and strength; while a cotton filling provided breathability and softness for the inside of a garment. The selected weave structures were more suitable for the outdoor market. They include both plain and oxford weaves for durability and drape. A satin weave was selected for a strong face and back differentiation. To create contrasting colorations the fabrics were cross-dyed with reactive and acid dyes. The lighter weight of these cotton-rich developments made them competitive alternatives to 100% synthetic fabrics.
- **Natural Lightweight Performance Blends:** Combining two natural fibers, cotton and wool, resulted in fabric with performance properties of both. Cotton, with its softness and breathability; wool, with its thermal regulation and odor control. This combination enhanced the aesthetic appeal of natural color variations and natural fiber textures. Intimately blended yarns, engineered into woven structures, added to the performance via texture and layers. This project was a follow-up to a well-received cotton/wool collection released in 2018.
- **Knit-Look Woven with Stretch:** A stretch woven-dobby fabric constructed to look like a knit while exhibiting the durability of a woven was developed for the outdoor lifestyle sector. The two-sided effect evolved from a sulfur blue yarn on one surface and a print on the other. A cotton/spandex, core-spun yarn added to the construction creating comfortable stretch in the width direction. The digitally printed fabric used reactive inks in a wavy embroidery-inspired pattern creating a unique visual effect.
- **Printed Indigo Knits:** The indigo knits in this collection, sourced from a European indigo yarn and fabric supplier, were used as a substrate in digital printing applications. A French terry construction, with the illusion of a woven fabric, provided a smooth base for printing, while the looped side added surface interest. These fabrics are double sided, offering versatility in garment styling. Furthermore, the knits digitally printed used reactive inks, mimicking artisanal Shibori techniques as well as fluid geometrics.
- **STORM COTTON™ Technology:** By employing Cotton Incorporated technology, two-unique knit fabric constructions ascended from fashion pieces to performance pieces. Because yarns were treated with STORM COTTON™ technology for water resistance, these constructions moved to the Active Outdoor knits’ category. This Active Outdoor grouping featured two different methods of applying the water resistance technology: First, a dip application used on a coarse gauge knitwear-sweater development; and secondly a pad/dry/cure application for a knit terry cloth. A seven-gauge,
jersey knit sweater, constructed with stripes of ploied colored-cotton yarns and novelty yarns was then accentuated with fringed edges. A 24-gauge, sinker loop terry with combed-cotton, ring spun yarns in the ground also incorporated a stripe pattern of the same ploied colored-cotton and novelty yarns as in the loop; thus, creating a novelty look of pixelated stripes. Combining fashion plus technology was received well at the OR Show in June.

- **Sueded Performance Cotton with TransDRY® Technology:** This collection researches the numerous possibilities around engineering moisture management fabrics; made possible because TransDRY® technology starts at the yarn phase. This collection featured three fabrics with varied yarn placements of regular cotton yarn and yarns treated with the hydrophobic TransDRY® formula. These fabrics were then sueded on a machine using fine-grit sand paper to achieve enhanced softness. Due to the strategic arrangement of yarns on the knitting machine the single and double knits exhibited either horizontal or vertical spread of moisture.

- **Textural Structures:** This collection of knits focused on sportswear. Coarse gauge ottomans, inlays, and jacquards are rich with texture and surface appeal in this grouping of top and outerwear fabrics. Mechanical finishing provided permanent surface interest as well as warmth and softness. Novelty yarns and stiches created structures which enhanced the insulative properties. All were developed in advance of the OR Summer Market.

- **Performance Mesh:** In this activewear knit grouping, the PD team developed mesh constructions incorporating openings for natural ventilation and used fine count yarns to achieve lighter weights, matching those of synthetics. In this project, a minimum content of 76% cotton blended with either polyester or nylon filaments created openings in the fine gauge knit fabrics. Cotton yarns, treated with TransDRY® technology, added the needed hydrophobicity to spread moisture and reduce absorbent capacity.

- **Combining Antimicrobial and TransDRY® Technologies:** In an activewear knit development, XT2® polyester filament is an antimicrobial technology. The XT2® polyester utilizes the antimicrobial properties of silver to stop odor by inhibiting the growth of bacteria. A jersey and mesh feed-stripe was constructed using cotton treated with TransDRY® technology, regular cotton, and XT2® polyester. The placement of TransDRY® yarns in the construction allowed for the quick spread of moisture, ultimately resulting in a faster drying fabric, while the XT2® antimicrobial yarn was included in the fabric to minimize odor during wear.

- **Cotton Incorporated Dual Technologies:** New fabric developments in this collection extend opportunities Cotton Incorporated has to market technologies. For example, the existing formulations of STORM COTTON™ and TOUGH COTTON™, as well as TOUGH COTTON™ plus TransDRY® technologies, mixed well to form dual technologies. Dual technologies, completed in advance of the 2019 OR shows, generated increased interest during interactions with major brands. Product Integrity has also provided support, by highlighting sustainable features of the dual technologies using data from the most recent cotton LCA. Fabrics included in the dual functionality collection include a coarse-gauge 3x3 rib with STORM COTTON™ and TOUGH COTTON™ technologies and a 1x1 stretch rib treated with TransDRY® technology combined with jersey fabrics finished with TOUGH COTTON™ technology. A durable woven bottom-weight with similar technology combinations was displayed during OR as well.

- **Color & Stitch:** Developed for the active and lifestyle markets, double knit cotton-rich jacquards and double face constructions were the basis for a fashion plus function collection of boldly colored fabrics. Combining cotton with polyester and nylon allowed for greater contrast when dyeing, overall lighter fabric weights, and unusual tactile qualities. These mid-layer knits were finished with non-formaldehyde (NF) STORM COTTON™ technology reducing absorbent capacity and providing some water resistance.

- **Lightweight Performance Flat Woven Fabrics:** Requirements imposed by brands create challenges in competing with synthetics in the active outdoor space. The industry is requesting very lightweight fabrics and shorter dry times. The PD team has focused on this challenge by researching cotton solutions. Lightweight cotton developments include a shirting fabric blend, 97% cotton/3% spandex, at 2.8 ounces per square yard. A weight that falls in line with the super lightweight nylon and polyester used currently in the market. Cotton developments in shorts and pants fell into the 3.5 to 4.5 ounce per square yard weight range. As comfort and movement is of importance within these challenges, spandex blended in the weft direction, added 10-15% stretch. Distributions of yarn treated with TransDRY® technology in the warp and fill directions enhanced moisture management and encouraged a reduced dry time. Plain weave, satin, ripstop, and twill constructions were part of this project.

**Internal Swatch Cutting Services**
The PD Sample Cutting area prepares fabric swatches and information for all marketing and technical activities. Since January, this has meant fulfilling 162 unique requests, from 114 different companies, for 2,063 fabric swatches. Additionally, 6,005 swatches provided to the Fashion Marketing and TCR departments to supplement their presentations and technical visits.
New Product Research
New product uses for cotton continue to evolve with the completion of the first prototype of a cotton knitted shoe. The prototype presented a variety of problems, as anticipated and the next phase will involve several changes.

Cotton-Bale Twine Research
The PDI team has begun collaborative research into a cotton alternative to synthetic hay-bale twine, engaging a team of researchers from FP, PD, AERD, and FC. Additionally, PD worked with AERD on developing a lower cost solution for creating panels used in cotton fields to control insects. Using in-house fabric, PD created a prototype bug-shake sheet, complete with cost and material sourcing details for AERD to share with producers.

Smart Textile Research
Research and development continues throughout PDI exploring new solutions in the wearable electronics and e-textiles field. Staff from PD and Textile Chemistry Research (TCR) received training on specialized in-house textile chemistry and dye process. Ongoing research with an enzyme company has reached its third phase; conducting trials on an improved one-bath process, which contains both acid and neutral cellulose enzymes. These trials will compare the more sustainable one-bath option to that of a traditional two-bath options, which contains both acid and neutral cellulose enzymes. If mills would use the one bath option, they would save water, energy, chemistry, and time versus a traditional two-bath process.

Mechanical Pleating on Cotton
Mechanical pleating describes the process of placing a pattern of creases onto a fabric by mechanical means. The size and shape of pleats range from simple knife or box pleats, to novelty scalloped or random pleat designs. A partnering textile university conducted pleating trials on a variety of fabric substrates. Research concluded that the use of NF resins helped to lock in the mechanically produced texture.

One Bath Bio-polish and Dye Trials – Part III
Ongoing research with an enzyme company has reached its third phase; conducting trials on an improved one bath bio-polish and dye process. These trials will compare the more sustainable one-bath option to that of a traditional two-bath options, which contains both acid and neutral cellulose enzymes. If mills would use the one bath option, they would save water, energy, chemistry, and time versus a traditional two-bath process.

Newness Retention for Cotton
The TCR team is developing a finish application for cotton to extend the ‘as-new’ appearance of a newly purchased garment. This includes improving smoothness, abrasion resistance, and color retention. The finish will be applicable to knit and woven fabrics. Initial results showed the formula could achieve similar colorfastness and color retention, but only with minimal products.

New Formulation of a Non-Formaldehyde Wrinkle Resistant Finish (NFWRF)
Smoothness Rating describes the hand (or feel) of fabric. After laundering and tumble drying the Smoothness Rating is visually assessed. The rating is on a 1 to 5 scale, with 5.0 having no wrinkles. Based off this rating system, the TCR team is developing a finish to achieve a 3.5 or better on top- and bottom-weight fabrics. To date, garment dip applications using PUREPRESS™ technology on cotton shirts have been encouraging; and additional garment dip trials are planned.

Optimization of Non-Formaldehyde Durable Press Resin (NFDPR) Finish on Cotton Knits
Throughout the industry, resins help improve durability in textiles. The TCR team continues to optimize NFDPR formulations to determine the best overall parameters for applying the technologies. Cotton Incorporated has recently developed an NFDPR technology specifically for cotton knit fabrics. Ongoing trials are examining durable press, wicking, and dry time performance to better optimize the final formula. Previous projects involving resin on knits have shown potential for improving fuzzing/pilling as well as quicker wicking/faster drying properties. The incorporation of a modified polyurethane has enhanced wicking in some
cases with resin finishes. To date, PUREPRESS™ technology, especially with the modified polyurethane, has yielded some encouraging results on knits, with and without calendaring.

Flame Retardants (FR) for 100% Cotton Fleece
All flame retardant fabrics must pass a 45-degree angle flammability test. Cotton fleece fabrics will normally fail the 45-degree angle flammability test required for all consumer apparel. Meaning, to pass this test roughly 20% polyester is blended into the pile of a cotton fleece. A non-formaldehyde FR system for 100% cotton fleece fabrics has been developed with the aid of an NF crosslinker. The non-formaldehyde crosslinker used provides similar FR properties with less strength loss than its conventional formaldehyde-containing counterpart.

Optimization for Moisture Management Technologies Using Non-Fluorine Durable Water Repellent
Production trials are running on new more durable and less expensive formulations than what are currently available. The new intention is to provide alternative options to mills. Lab trials suggest that some non-fluorine water-repellents attract detergents to the treated articles when washed. Spray testing after 30 home launderings in testing data (HLTD), both with and without additional water rinsing, confirms that detergents require removal with at least three “water-only” launderings. Design continues on the application concentration of the STORM COTTON™ technology treatments.

Non-Fluorine STORM DENIM™ Technology
Work to identify a durable non-fluorine water repellent treatment continues. As application techniques were studied to improve the water repellency chemistry of STORM DENIM™ technology, a finish confirmation trial was run with the top four non-fluorine and C6 water repellents. Each application was co-applied with and without silicone water repellents, and/or a chelating sequestrant, conforming to the STORM DENIM™ treatment requirements. The results suggest that both non-fluorine and C6 water repellents require the co-application of a type of PBI cross-linker and a chelating sequestrant to improve the water repellency of the STORM DENIM™ treatment. Non-fluorine production trials are planned for later in 2019 with a mill in China.

Sweat Hiding Technology
Development work on sweat hiding technology continues seeking a softer hand, durable to print on lightweight woven goods, while still allowing sweat to soak into the underneath side of the fabric but not all the way through. Lab trials compared two formulations of the technologies after 30 HLTD to confirm their durable application visually and with the Moisture Management Tester (MMT), used in determining one-way moisture transport: a soft-hand non-fluorine formula and C6 WICKING WINDOWS™ print formula. Either formula, when applied to either jersey knits or interlock knits, maintained a one-way moisture transport after 30 launderings, which was better than the original treatment developed with just C6 technology. In subsequent trials, the same non-fluorine and C6 print paste, made for WICKING WINDOWS™ finish, were applied using a Blotch print screen. This application applied Sweat Hiding technology to both jersey and interlock knits (on the outside fabric surface, not the inside as with traditional WICKING WINDOWS™ finish applications). The biggest difference between the print applications designed for WICKING WINDOWS™ and Sweat Hiding technology is in the application concentrations with the WICKING WINDOWS™ finish having a lower concentration. Results suggest the following conclusions:

- To hide sweat, new C6 chemistry can be durably applied at the same low application concentration as the WICKING WINDOWS™ finish, and

- The application of two new, non-fluorine water repellents applied in the Sweat Hiding print, at lower levels, can continue to hide sweat after 30 HLTD.

Non-Fluorine TransDRY® Yarn & Non-Treated Yarn — The Effects of Dye Structure on the Differences Between Dye Uptake
Technical Services and Implementation (TSI) encountered an issue where a mill in Peru was having trouble dyeing Union Shade on fabric containing alternating feeds of a non-fluorine yarn treated with TransDRY® technology. The project goal was to provide the mill with a solution that would allow them to dye their fabric without shade-depth differences between the non-fluorine yarn treated with TransDRY® technology and the untreated yarn. Initial dyeing was conducted in-house using yarn provided by the mill. The yarns were then knit into one-inch bands of non-fluorine yarn treated with TransDRY® technology and untreated yarn. This resulted in the discovery that, contrary to conventional assumption, the non-fluorine yarn treated with TransDRY® technology was actually dying darker than the untreated yarn, rather than lighter. After this discovery, additional trials researched various reactive dyes. Each trial represented various dye structures, different reactive and solubility groups, all within the dye molecule. The results indicate that while the non-fluorine water repellent demonstrates cationic characteristics, it is actually more complex than that. With 80 lab-dip results analyzed to date, data suggests that the problem is primarily inherent to mono-reactive, Vinyl Sulfone dyes with two or fewer solubility groups. However, there are dyeability differences on other dyes.
to various degrees based on differences in chemical structure and color. The most prevalent dye is Reactive Blue 19, which happens to be the dye used in the mill’s formula. The following analysis is ongoing: Phase 1 — Identification and Prediction of Problem Dyes; Phase 2 — Identify Different Non-fluorine Water Repellents that Minimize or Eliminate the Dye Difference Issue.

Outside Research: Fabric Degradation Study
This study will quantify and provide scientific evidence, in a controlled laboratory experiment, of the influence various finish chemistries have on the biodegradation or decomposition of cotton fabrics in compost conditions. Degradation testing for an initial set of samples require a 150-day duration, and initial testing is complete and the report is filed. The finishes did appear to have different impacts on the degradation behaviors of each fabric sample. Among the finishes, a control of untreated cotton was established. The principle investigator concluded that finish does have an impact on the biodegradation rate of fabrics but no-matter what finish is applied, cotton will still degrade in compost conditions. The researchers from Cornell and North Carolina State University plan to publish a collaborative report in The AATCC Review.

Outside Research: Continuous Mercerization of Loose Stock Cotton
This project is aimed at allowing loose-stock cotton fiber to be mercerized immediately following ginning. Compared with un-mecerized loose stock, the project hypothesized that these mercerized fibers would be stronger, potentially longer, straighter, more lustrous, and with activated surfaces that could then be amenable to further finishing treatments. It was hypothesized that the mercerized fibers would suffer less breakage during subsequent processing. Therefore, increasing the quality of spun yarns by reducing the unfavorable qualities inherent to immature fiber.

However, the close of this project has concluded that the required apparatus in the process needs further development before it can become a viable hypothesis. Results for whiteness and yellowness were not included in the final report, as the research team believes the wooden frames, used in the apparatus, caused severe staining of the fiber samples. The research team also concluded that the belt-mercerized samples did have better dyeability than the slack mercerized sample, and that both mercerized samples had better dyeability than the control. However, the initial discoloration of the mercerized samples and other inconsistencies in the dyeing procedure brought that conclusion into question. This project was completed, and no further research is anticipated.

Outside Research Project: Reactive Dyeing of Cotton Using Cottonseed Oil/Water System
This outside research project carried over from 2018. The objective in 2019 is to achieve a high level of color evenness in hot, warm, and cold dye baths using a cottonseed oil/water system. The project hopes to achieve an overall increase in efficiency by enhancing the method of removing cottonseed oil from dyed cotton fabrics. By reusing the collected oil in a continuous dyeing cycle, you become more sustainable and reduce overhead.

During the first quarter, researchers blended the dye solution/cottonseed mixture with a Ball Mill to explore the impact of mixture ratios and different droplet sizes on the fixation and levelness of dyed samples. Larger droplet sizes contribute to higher fixation rates; however, the Delta E (ΔE) is greater for larger droplets. Researchers believe this occurred because larger droplets are less stable in the emulsion, which causes them to move quickly onto the fabric. Once the large droplets are in contact with the fabric they do not disperse readily through the fabric, which leads to poor levelness. The researchers also explored the impact of various percentages of water content in the aqueous dyed solution/cottonseed oil dyeing system. Lower percentages of water contributed to higher K/S values, however the ΔE also increased indicating decreased levelness.

Outside Research: Six Sigma Approach to Dyeing
The objectives of this research were to quantify the actual savings that are realized when a commercial firm adopts a Lean Six Sigma approach to cotton dyeing. Quantifiable metrics are to measure and offer suggestions based on cost, time, water, dye, energy, and percent of revisions. This project was completed and results were presented to the AATCC Chemical Applications Interest Group. Results were so well received that a journal article was submitted to the AATCC for publication.

Outside Research: Improved Thermal Management Performance of Bedding Systems for Effective Recovery in Dynamic Sleep Environments Through Cotton-Containing Products
This research project was developed to investigate, identify, and highlight the unique thermal, humidity, and moisture management benefits of cotton products when next to the skin in sleeping environments. Results were compared to competitive non-cotton synthetic products, and new treatments claiming to provide a positive impact on the cotton market. Results of this study show that cotton is the preferred fabric for both sleepwear and sheeting from the standpoint of comfort, in both humid and warmer climates.
Outside Research Project: Processing and Property Evaluation of Nanocellulose Extracted from Cotton Waste
This research project will investigate the influence of various nanocellulose extraction processes on the yield and properties of nanocellulose from cotton waste. Processes include disk refining, sulfuric acid hydrolysis, and TEMPO oxidation assisted with the high pressure homogenization process. Using the disk refining process a pilot production of nanocellulose is scheduled and data on processing parameters and nanocellulose properties will be collected. Techno-economic analysis will be prepared to compare the yield, chemical/energy, consumption, and properties of nanocellulose produced from cotton waste to those obtained from wood waste.

Outside Research Project: Producing Carbon Fiber/Fabric Using End-of-Life Cotton and Application Development
This project will investigate carbonization conditions of cotton in hydrothermal and microwave carbonization processes, with respect to desired carbon properties and functionalities for targeted applications. Proof-of-concept products will then be developed using the produced carbon from cotton and will include a novel high-performance poly lactide (PLA) system, high performance self-healing epoxy coatings/adhesives, supercapacitor electrodes, and liquid or gas absorption/separation devices.

Screening of Various Polyethylene Softeners for Low Curing TOUGH COTTON™ (Without Resin) Technology for Cotton Socks or Cotton Yarns for Socks or Other End Uses
Using available yarn dye and sock processing equipment, trials continue seeking to develop a method of applying TOUGH COTTON™ technology on socks. Even though the TOUGH COTTON™ technology has been gaining momentum for Cotton Incorporated, would be beneficial to develop a method to exhaust this technology onto yarns and potentially fabrics. Initial trials (using dip/extract/dry/cure) on cotton socks provided excellent results using the modified Martindale Abrasion test method. Additional trials in the DFAL are performing well. Knitting will begin soon for the package trial.

New Platform for Cationization of Cotton
The TCR team is working to develop a new cationization cotton platform, based on a newly patented cationization molecule Bis-ether-di-quat (BEDQ) from a major chemical supplier called ECOFAST™ Pure. The newly developed molecule has no odor and possesses a much higher efficiency compared to traditional cationization reagents. The TCR team has compared the reaction efficiency of the new quat-BEDQ, as compared to quat-188, in a cold-pad batch process, a pad-cure process, pad-steam process, and exhaust process. Additionally, the lab has carried out cationizations utilizing the chemical supplier’s kinetic calculators. The team concluded the new bifunctional quat is clearly more efficient during cationization in these processes, but the final step in this project is to compare dyeability differences between the two quats to ensure that it dyes similarly as well. To do this TCR will first prepare black shades, then determine the cationization amount and dye amount of both quats. Next, data will be compared to a 5% self-shade of Novacron Super Black R. In addition, TCR will run tests to compare the colorfastness of the new quat-BEDQ, to both quat-188 and the control dyeing. As a side note, in 2018 this project made it apparent that there was contamination in our #2-carbon filter for processed water. As noted, the filter was re-bed over the Christmas Holiday in 2018. A check at the end of January 2019 revealed we are no longer experiencing the issues of yellowing and contamination when treating cationic cotton and the project has continued.

Crosslinking Polymers for Durable Press (DP)
Explore the possibility of utilizing developmental non-formaldehyde crosslinking polymers to impart DP properties to cotton by evaluating the smoothness and physical properties of cotton fabric with crosslinking polymers applied. The TCR team has conducted several rounds of trials and found very encouraging smoothness results, especially when the polymers have been combined with low levels of DMUG (a non-formaldehyde resin). The biggest challenge with utilizing the polymers in a finish bath is that the acidity level of the polymers cause precipitation of other finish bath components. We have found a combination of alternative finishing components that do not precipitate when combined with the polymers. This concept of utilizing crosslinking polymers to impart durable press to cotton needs further exploration.

Low Formaldehyde Durable Press
The TCR team is developing a low-formaldehyde resin treatment that provides improved strength retention and “no-iron” DP performance (The goal is a DP rating ≥ 4.) To date, a dress shirt treated with non-wrinkling SportDRI™ finish can dry in five minutes when tumble-dried. The SportDRI™ finish, developed by a co-application of the SportDRI™ treatment with DMUG and two different DMDHEU resins, and applied with less than 16 ppm of formaldehyde (allowable detection limit), imparts a durable press rating of 3.4 after 30 HLTD on woven-cotton shirting fabrics.
Pre-Treatment for Disperse Dyeing of Cotton
Develop an economical pretreatment that would enable cotton to be dyed with disperse dyes. This would facilitate a one bath dyeing of a cotton/poly blend and allow cotton to be dyed with neon shades. Initial supercritical carbon dioxide (sCO₂) dye trials were conducted at a lab in Pennsylvania, on fabrics treated at Cotton Incorporated, utilizing a TSP emulsion. Work will continue to evaluate new chemical options in partnership with the U.S. brand.

Cationic Antimicrobial Treatment for Cotton
The project goal for a cationic antimicrobial treatment for cotton is to: provide an alternative treatment to silver that has high performance that could open new markets for cotton in the medical and hospitality areas. Samples developed by PDI were supplied to an independent antimicrobial testing lab. The lab analyzed the samples under the auspices of ASTM E3160 test method. The antimicrobial cationic cotton concept has not yet been tested with this methodology. Results show, when exposed to E. Coli, all treated samples demonstrate a 100% reduction at 24 hours.

Cotton to Sugar
The goal of this research is to develop a process that allows cotton-based textiles to be enzymatically digested into sugar, with potential to further obtain ethanol, or other value-added products. Lab work slowed in the second quarter to spend time fully documenting prior work. Through outside counsel, TCR has submitted a provisional patent to cover the work-to-date developed at Cotton Incorporated. Textile Chemistry Research recently conducted a scaled-up trial running a larger batch, but in a continuous process. Additional trials are planned. The PDI division has signed an agreement to work with NCSU in evaluating a mechanical-fibrillation pretreatment technique. In addition, TCR commissioned a business analysis of this concept, which was very encouraging and somewhat surprising as to the potential for profitability. Some of the suggestions made by this group require that PDI explore new options that may have to be done offsite. After having a formal meeting in February 2019, PDI finalized a path forward, taking advantage of the momentum of this project.

Durable Thermal Regulation Finish for Cotton
This project is developing a durable, non-formaldehyde thermal regulation, finish for cotton. By incorporating Cotton Incorporated’s moisture management technology into the finish, PDI can expand cotton’s presence in activewear market. In this study, TCR printed a combined chemistry of phase change material (pcm) and non-fluorine WICKING WINDOW™ technology on knit and woven fabrics. The knit fabric already contained TransDRY® technology; adding multiple-technologies to one fabric application. After, 20 HLTD the samples were evaluated using Color Spectroscopy and MMT Testing to evaluate the durability of the finish and the functionality of the WICKING WINDOW™ technology. The results seem promising using a non-fluorine chemistry combined with pcm.

Cotton in New Markets: 3D Printing
This research is exploring using cotton fiber in the materials used to print 3D objects. Textile Chemistry Research is looking for new opportunities to introduce cotton into the market and 3D printing is a growing trend. The TCR team is working with an outside company to develop injection-molded products such as hangers, small storage boxes, and toothbrushes. Each of which contain a percentage of cotton fiber. The TCR department has purchased a second 3D printer for research and development (R&D). Prototypes have been printed and are now showcased at different conferences and tradeshows. The TCR team is also now determining a way to analyze the finished products examining the advantage(s) of adding cotton to the products.

Different Chemistries for Thermal Performance
Evaluating the heating performance of various finishes and yarns applied to and blended with cotton is underway. Recently, there is high interest in the concept of bio-ceramics. Most noticeably in the sleepwear category on products marketed with rejuvenating finishes. To begin the study, different print formulations were evaluated alongside cotton-blended fabrics. To date, interesting results have been collected. With regard to the cotton blends, first an Ne 18/1 yarn was spun and blended with acrylic, then knitted in-house. Next, a cotton was blended with nylon fibers, containing 3% graphene; then blended again with a cotton carbon fiber. Both blends exhibited heating characteristics. Of the blends, the graphene blend performed best concerning heating. In the next phase, a ceramic-carbon black was both foam printed and screen printed on regular cotton fabric samples. After washing, samples will be tested to collect data.

Evaluation of Performance Sheet Sets
Questionable marketing claims spurred this project to focus on evaluating various claims that a company was making regarding their synthetic sheet set as compared to a traditional cotton sheet set. The company’s knit synthetic sheets were then compared to both woven and knit 100% cotton sheet sets. Tests evaluated a variety of different properties and virtually all of the claims
Installation of New Machinery
The most advanced airjet spinning technology, a Murata MVS 870, was installed in 2018. The machine has the ability to run at higher speeds while producing better qualities than the previous MVS technology. In 2019, the FP technicians performed a complete spinning limit trial from Ne 12/1 – 60/1 yarns and developed “soft hand” MVS yarns. A control MVS and best “soft hand” MVS yarn were spun and sent to PD for knitting. The fabrics will undergo a full evaluation after they are dyed and finished.

New, AgTek Multi-Function winders were installed in May 2019. Setup and initial testing were completed with utilization underway to produce yarns for PD in the area of flatbed knitting. Yarn packages, with up to five plies, were produced from fine count yarns of multiple colors, then transferred to knitting for eventual fabric trials. Additional testing being performed on “fancy” or “slub” yarns is creating cotton yarns with elastane cores, as well as conventional “covered” yarns.

Technical Service Meetings with Yarn Spinners and Manufacturers
Fiber Processing provided technical services at a mill for a domestic spinner, minimizing problems associated with cotton crop change, with the assistance of the Product Evaluation Lab (PEL), who analyzed test data to advise optimum process settings. The FP team also provided support to a U.S. supplier of ASTM standardized test material, for use in worldwide Random Tumble Pilling Tests. For controlled processing, the test material will be processed in the FPL, adding a combed sliver, then delivered back to the supplier.

Production of High-Quality Yarns for Shirting Research
In support of PD, FP produced high-quality warp yarns for a shirting development. The yarns were produced from a laydown of a high-quality Upland cotton. After a premium level of combing, yarns were spun on a compact ring spinning system to produce superior softness with lower than normal twist. This yarn will provide support in the development of higher-quality lightweight shirting material produced from Upland cotton.

Combing Quality Research
To advance the production of higher-quality combed cotton yarns, FP conducted research, specific to the combing process, for technical service use with yarn spinners. Three rates of short-fiber (noil) and two directions of fiber-feed were selected to determine optimum combing efficiency and yarn quality for today’s longer Upland cotton. Ring spun Ne 30/1 yarns were produced to represent all variables and a technical report is pending upon completion of all physical testing.

Cotton Origin Project to Evaluate Capability of Potential Fiber Identification Technology
Fiber Processing provided fiber, yarn, and fabric from two known states for evaluation of a potential fiber identification technology. Processed sliver, and carded ring-spun yarns, were spun for comparison purposes. With the combined assistance of PD and the Dyeing, Finishing and Analytical Labs (DFAL), both greige and dyed fabric, slated for t-shirt production, were also delivered. All samples were then provided for testing to determine origin of the raw cotton used.

Evaluation of U.S. Grown Raw Hemp Fiber Blended with Cotton
Cotton Incorporated’s FP team engaged in development work to evaluate the feasibility of spinning cotton/hemp blends on a short staple spinning system. The hemp was up to 7 inches long and contained very coarse fibers. The FPL evaluated a blend of 87% cotton with 13% hemp (as delivered). The hemp resembled the barky plant material sometimes found in raw cotton. The FPL technicians did not experience any major issues in opening and cleaning, carding, drawing, or roving. However, once the material was taken to spinning and set up for Ne 20/1, the ring spinner realized 100 times more ends-down per spindle hour,
than what is normally acceptable on the ring spinning frame. This type of ends down rate is not commercially viable and related directly to the coarseness of the hemp fibers. The trial concluded as follows:

- Quality of hemp sent for this trial is not suitable for the short staple spinning process.
- Yarn experienced 100x the normal ends down in ring spinning of Ne 20/1 yarns.
- Hemp suppliers should find partners that are developing refining machinery that can better prepare the hemp for short staple spinning with cotton.

Developments on Amsler Core Spinning/Wrapping Technology
Following, the installation of an Amsler “Wrap Yarn” system on an existing Zinzer 351 ring spinning frame, FP continues developing parameters to improve the operation of this new wrap-yarn effect yarn. The goal is to produce a final yarn with improved hand and/or special performance and visual attributes. While the initial fabrics produced from this effect yarn showed promise, machine efficiency (and ultimately commercial viability) remains a major hurdle. Because of the way the yarn is produced, the friction created when knitting causes excessive fly, which in turn can build up around the needle bed. To overcome this issue, the knitting frame was slowed to approximately 50% normal speed and stopped often for cleaning the excess fly. Additional testing will be required as more fabric is produced to determine colorfastness, pill rate, and overall durability. During meetings in May and June, the FP team conveyed issues to the machinery manufacturer to try to assist in creating positive solutions. Fiber Processing, will continue to work on this interesting but problematic novelty attachment.

Internal Fabric Development Assistance
PD provided technical fabric development expertise to evaluate seed varieties, spinning systems, and new finishes. Fabrics were developed in support of the ISP program and for research into new yarn treatments.

Cotton Incorporated Technology Implementation Advancements
The Technical Services and Implementation team remains at the forefront of expanding Cotton Incorporated’s technologies through continued research and internal optimization trials. Work includes internal and external technical assistance, production scale trials, and implementation services with mills and manufacturers to advance cotton in global markets. The following are key advances made to date in global markets.

- Implementation of the PUREPRESS™ technology continues with numerous trials run and scheduled. Trials have advanced by mills interested in becoming licensed suppliers of the technology, as well as brand interest. Mills in China, S.E. Asia, Pakistan, India, Mexico, and South America have run trials, or are planning to run trials in Quarter 3 of 2019.
- Implementation and support of TOUGH COTTON™ technology remains strong with more mills and brands running trials (largely in S.E. Asia). Testing submissions from trial and production runs increased in 2019.
- Implementation trials using STORM COTTON™ and TOUGH COTTON™ technologies without resin, plus TransDRY® technologies, continue with new brand and mill interest.
- The TSI team is assisting a U.S. brand in expanding their U.S. supply chain of the STORM COTTON™ technology.
- The experimental-implementation efforts surrounding joint research, known as the TransDRY® Dyeability Project, continues to progress since last reported in December 2018. This joint project, with TCR, supports the changeover of several South American mills to non-fluorine TransDRY® technology later in 2019.
- Cross-divisional support has been critical in the development and application of dual technology fabrics in the DFAL with the Dyeing and Finishing Lab processing close to 200 pounds and 250 yards of fabric for this project alone, producing a total of 1,800 pounds year-to-date for a variety of internal research, FABRICAST™ collections, Marketing support, and/or technical support services. The Analytical Lab has processed 49 service requests to date, with the Technical Services team processing 187 service requests year to date.
- Each department within PDI works together continuously providing technical fabric-development expertise at every stage of the process. Their expertise is utilized in the annual evaluation of new seed varieties, novelty yarns, smart fabrics, or performance finishes which hopes to regain lost-shares from traditional markets while advancing cotton into new markets.
Strategic Objective 3: Augment cotton marketing activities/influence industry decisions through technical avenues such as standardization and education.

Sustainable Apparel Coalition (SAC)
Work to refine the final methodology details of the SAC Product Tool has been taking place during weekly web meetings in the first half of 2019. Methods are only one piece that needs to be created before SAC, and the new Higg.co LLC, can release the Product Module. Because validation, training, and transparency also must be in place, the release date has been pushed back to 2020.

Participation in USDA Gin Schools
The FP team instructed at both Gin Schools held in Lubbock, TX, and Stoneville, MS. Instruction was provided for three-levels, in addition to continuing education classes, that allowed ginners to receive their Cotton Ginner certification. Instruction and demonstrations focused on the processing of cotton after leaving the Gin and the importance of proper ginning methods. Both schools stressed the importance of fiber quality, with an exclusive presentation of FP's Low Micronaire Cotton Research as the focus of the school in Texas.

Participation in TechTextil 2019
Techtextil Frankfurt, held every two years in Germany, is the leading international exhibition for nonwovens and technical textiles, bringing together hundreds of vendors representing all aspects of product development. Techtextil Frankfurt 2019 delivered on its promise to shift focus towards sustainability on all parts of the global supply chain. The vote in March from the European Parliament to ban single use plastics, has many companies rethinking their manufacturing strategies. With similar legislation proposed in Canada, North America may see a similar shift in the near future. Companies are making it economically viable to use more cotton in all nonwovens processes. A newly opened, Customer Innovation Center, in Egelsbach, Germany, emphasized many of the new technologies allowing for more sustainable manufacturing.

Participation in FLAME30
In support of PDI, members of PI and TSI presented at the FLAME30 conference covering recent flammability research conducted by TCR and the AL departments. Materials were well received.

Participation in an International Textile & Machinery Exhibition (ITMA) — 2019 Machinery Exhibition
In June, PDI team members attended ITMA 2019. Held every four years in Europe, ITMA is the marquee exhibition for nonwoven and textile machinery manufacturers from around the world to show off their latest technological advancements. The FP team set up meetings with major companies offering contamination detection, new airjet spinning, novel yarn systems, and nonwoven/fiber processing technology. During the third quarter, a summary of highlights will be consolidated into a written document that can be shared with textile and nonwovens companies, manufacturers, and retailers.

Product Integrity attended the ITMA show, in addition to the Planet Textiles conference, and the SAC 2019 Annual Meeting. Sustainability claims at ITMA seem to have increased in the dyeing and finishing phase. In preparation for the SAC annual meeting, the Product Advisory Council (PAC) was able to hold an extended work session on topics that needed advance in-person consultation. The PAC focused on an initial outline of how products' validation might work, and how the Product Module tools could fit into SAC transparency framework to inform consumers of a products' sustainability. Based on an idea from a 2018 meeting, a draft Product Impact Calculator tool that shows consumer use impact was designed and reviewed. Meetings concluded with data collection needs discussed.

Industry Engagement
Staff use the industry engagements to development new ideas, source new cotton yarns and fabrics, as well as meet with vendors, discussing possible collaborations. Technical staff from PDI assisted Account Managers at Cotton Incorporated booths during trade shows, presenting new fabric developments and answering technical questions. Listed below are trade shows, conferences, and/or presentations the PDI team participated in to date.

- Outdoor by ISPO, Europe (January)
- West Texas Cotton Producers Conference, U.S. (January)
- ASTM International Meetings, U.S. (January)
- Outdoor Retailer (OR Show), U.S. (January, and June)
- Techtextil, U.S. (February)
- AAFA Product Safety and Environmental Control Committee Meetings, U.S. (February)
- The Pittsburgh Conference and Exposition (PITTCON) 2019, U.S. (March)
- New York Home Week, U.S. (March)
- AATCC International Conference Event (ICE), U.S. (April)
- Great Ideas in Cotton Conference, Hong Kong (May)
- Innovate Textiles & Apparel, U.S. (May)
- Performance Days, Europe (May)
- The Sustainability Consortium (TSC) Summit, U.S. (May)
- The FABRICAST™ Collection 2019-Release, Asia (May)
- Flame Retardancy and Lightweight Transportation Materials Conference (FLAME 30), U.S. (May)
- Asian Nonwovens Exhibition and Conference (ANEX 2019), Japan (June)
- ITMA 2019, Europe (June)

Blue Jeans Go Green®
In support of Consumer Marketing’s Blue Jeans Go Green® sustainability program, PD compiled a resource packet highlighting some of the sustainable denim projects developed at Cotton Incorporated. The concepts are meant to serve as support materials for Cotton Incorporated’s interactions with potential industry partners. Product Integrity has supported by providing the LCA of the denim insulation.

Garment Review
Product Development provides Fashion Marketing support by designing swatch notebooks made for the analysis of fabrics and resourced from garments supplied by the Fashion Marketing department. The PD team allocated time, for a technical review, complete with explanations for the Fashion Trend Analysis Team. The notebooks provided analyses on 138 knit and woven fabrics. The technical fabric descriptions enhance their seasonal trend presentations.

Industry Publications
Two industry journals, the International Cotton Advisory Committee (ICAC) and AATCC, published articles provided by PD complete with fabric images, regarding information about denim and cotton innovations. Product Integrity has worked with a group of LCA experts to write a paper, now ready for submission, on LCA misconceptions and critical review.

Global Research
In May of 2019, a cross-divisional trip through Asia was executed to further market reach, educate industry leaders, provide technical assistance, and follow-up on recent technology implementations. Information covering the microfiber research and an overview of cotton technologies was presented during the Great Ideas in Cotton 2019 Conference in Hong Kong to almost 400 people. Following this conference, the trip continued with several mill visits, sharing information on cotton technologies, which included Sweat Hiding, PUREPRESS™, and STORM DENIM™ finishes. Several meetings with chemical companies presented learning opportunities during this trip. Team members discussed experiences and concerns with certain chemistries as well as learned about new offerings from the different companies.
GLOBAL SUPPLY CHAIN MARKETING COMMITTEE

GLOBAL SUPPLY CHAIN MARKETING

The scope of the GSCM division covers a wide range of activities with manufacturers, retailers, brands, and trade organizations throughout the world. These activities are anchored in three important strategic objectives: build a global presence for cotton, promote product and technology ideas, and conduct education, training, and technical assistance through marketing programs that further the use of cotton in products.

**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 first half of 2019, GSCM staff conducted more than 325 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 first half of the year. In both January and June, staff participated in the Outdoor Retailer Shows in Denver, CO. This tradeshow is the largest U.S. industry 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. The front of the booth at both shows featured mannequins dressed in garments designed by a leading garment innovation studio out of Portland, OR. These garments featured FABRICAST™ collection fabrics that were enhanced with TransDRY® and STORM COTTON™ technologies. Inside the booth, a natural and responsible fabrics section highlighted cotton/wool fabrics and other responsibly processed fabrics from the FABRICAST™ collection, and garments made to showcase those fabrics. Collection designers, Studio 317, highlighted the new garment collection. At the June show, Cotton Incorporated’s Senior Trend Forecaster presented the Active Trend Forecast to a large crowd at the Trend and Design Center, where fabrics were on display for attendees to review. For the June show, marketing was amplified in promotions and banners at the Denver airport, aisle banners at the show, and banner signage at the door entries. Trade advertising also was implemented as part of the overall presence for cotton at these important trade shows.

In February, staff attended The ISPO Trade Show in Munich, Germany. Meetings were held with major brands and suppliers for the outdoor industry. This show presents an opportunity for cotton to penetrate key European markets.

Mexico City staff hosted the Fall/Winter Cotton Innovation Session in Mexico City exhibiting cotton technologies and the newest FABRICAST™ collection to 162 executives from 75 retailers, brands, garment manufacturers, and textile mills. The program also included Fashion Marketing and Consumer Outlook presentations. As a result, three major mass merchants requested to initiate conversations on the potential adoption of moisture management technologies.

Additionally, Mexico City staff attended regional shows and industry events such as Colombiatex 2019, Medellin, Colombia; The Mexican Textile and Apparel Annual Luncheon, Mexico City, Mexico; The Puebla’s Textile Chamber board meeting, Puebla, Mexico; the Outlook Nonwoven Latin American Congress, Sao Paulo, Brazil; and ITMA, Barcelona, Spain.

Mexico City staff granted four press interviews under the Spanish digital consumer campaign for Latin America known as cottonlatino.com. One interview was broadcast on the radio and the other three were published in national newspapers. The aim was to remind consumers to check labels and to recognize cotton’s sustainability and performance attributes over synthetics’ challenges, such as the microplastics in the ocean.

Global Supply Chain Marketing staff organized and held a one-day event, Great Ideas in Cotton, in Hong Kong on May 22, 2019. Great Ideas in Cotton was an international event showcasing how cotton is transforming the industry through sustainability, fashion, and innovation. The event featured a dynamic conference program, inspiring displays, and an exhibition area comprised
of 29 leading manufacturers. The event was attended by over 370 people, from over 180 companies and ten countries, consisting of textile/garment mills, dye houses, fashion brands, retailers, sourcing companies, and textile associations.

In conjunction with the Great Ideas in Cotton event, GSCM staff organized and hosted an executive dinner. The President’s Dinner was an opportunity to meet and network with key executives from major supplier, brand, and retail accounts. Attendees included 38 participants from 32 companies in the Asian region. Prior to the dinner, executives toured the Great Ideas in Cotton displays and visited with suppliers in the exhibition room.

GSCM staff exhibited at the 2019 Asia-Pacific Outdoor Show in Nanjing, China. Cotton performance technologies were displayed at the INOUTDOOR Lab which attracted around 20,000 visitors. A presentation on cotton technologies was delivered to more than 600 industry representatives.

GSCM staff sponsored and exhibited at Prime Source Forum 2019 in Hong Kong. More than 150 overseas and local representatives from key textile manufacturers, fashion brands, retailers, sourcing companies, textile associations, consulting firms, and government officials attended the two-day event. A total of 45 speakers presented at the forum, addressing a variety of topics focused on the textile and clothing business.

GSCM staff attended a Cotton Incorporated sponsored event, Sourcing Journal Summit in Hong Kong. Around 150 participants from the textile industry attended the half-day conference program and networking reception.

Additional participation in industry events included:

- Staff attended Home Fashion Week in New York City where meetings were held with top home textile companies.
- Staff attended the Americas Apparel Producers Network (AAPN) Regional event in Charlotte, NC.
- Staff exhibited at the TechTextil trade show in Raleigh, NC.
- Staff attended a major U.S. retailer’s Sustainable Fibers Roadshow.
- Staff participated in a U.S. retailer’s Raw Materials Supplier Fair.
- Staff participated in a panel presentation, along with four other speakers, at the University of Missouri. The presentations addressed designing products for special needs and attendees included students and faculty from many disciplines.
- Staff presented at Hong Kong Fashion Week in Hong Kong. The event attracted a total of more than 1,000 exhibitors and around 12,000 attendees.
- Staff presented at CIDPEX Conference in Wuhan, China. Around 500 industry representatives attended this two-day event which is the largest nonwoven exhibition for tissue paper and disposable hygiene products.
- Staff assisted with exhibits at IDEA 2019 in Miami, FL.
- Staff attended the Hong Kong Denim Festival 2019. The festival was a three-week cultural and design event to promote denim. It included a series of fashion design events, exhibitions, workshops, and seminars.
- Staff attended Intertextile Shanghai, Spring Edition in Shanghai, China.
- Staff attended the 15th ISPO Beijing Show in China. This outdoor retail market tradeshow attracted more than 40,000 visitors.
- Staff attended the 2019 SpinEXPO tradeshow in Shanghai, China. The exhibition attracted more than 200 yarn suppliers from around the globe and more than 10,000 trade visitors.
- Staff attended the China International Cotton Conference in Qingdao, China. More than 800 representatives from the textile industry attended the event.
- Staff attended the 2019 China Cotton Textile Industry Outlook & Dialogue with the U.S. Cotton Industry in Foshan, China.

GSCM joint activity with Cotton Council International (CCI):

- Staff participated and managed a booth at the COTTON USA Sourcing Fair in Macau. More than 200 representatives from around 150 companies in the region attended the event.
- Staff attended a CCI networking event in Hong Kong. The event was attended by 50 representatives from textile manufacturers, brands, and textile associations.
- Staff conducted a meeting with CCI Hong Kong representatives to discuss cooperation and planning.
- Staff attended CCI Global Staff Planning Meeting in Jaipur, India.
• Staff attended COTTON USA Cotton Day event in Qingdao, China.
• Mexico City staff attended the COTTON USA Sourcing Fair in Cancun, Mexico.
• Staff worked closely with CCI consultants in Asia, Latin America, and Turkey to execute programs of mutual benefit.

In its sixth year, the Cotton LEADS℠ program continues to educate and inform retailers, brands, and manufacturers about responsible U.S. cotton production. Cotton Incorporated participates in this program with the National Cotton Council of America, the Cotton Foundation, Cotton Australia, and Cotton Council International. In 2019, ten new partners joined the program, thus reaching a total of 570 partnering manufacturers, brands, and retailers.

Mexico City added three new Cotton LEADS℠ members. Additionally, the program will have a great at Business to Business (B2B) and Business to Consumer (B2C) exposure during the second half of this year because three members will be using the logo. One Peruvian mill will label more than 50,000 fabric and jeans samples, aside from catalogs, reaching retailers, brands, designers, and garment manufacturers in Peru. A Mexican mill will display the logo on its web page. Finally, the third largest Mexican mass merchant, will place the logo on labels and stickers on over half a million garments during the remainder of 2019 and then double that for the coming years.

The GSCM division is responsible for coordinating messaging to the trade. In 2019, consistent messaging and imagery was implemented throughout, including tradeshows, tradeshow promotional items and outlets, and other publications. In addition, new messaging was created for 2019 placement to highlight “the circular economy” and combination technologies. Trade advertisements were placed in industry publications, print and digital, during the first half of 2019.

**Strategic Objective 2: Develop and facilitate the adoption of product and technology ideas.**

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 that 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 division continued collaborations with outside organizations in the first half of the year. Partnerships included continued 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. Two collections of men and women’s garments utilizing FABRICAST™ collection developments and cotton technologies were developed with a leading garment innovation studio. These garments were showcased at tradeshows, industry events, and brand/retailer meetings.

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’s 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.

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. Cotton Incorporated continued to supply TransDRY® technology hangtags to support promotional efforts, which have a major global presence.

GSCM provided marketing support for a home textile company’s Seal of Cotton and Cotton LEADS℠ hangtag adoption. The Seal of Cotton and Cotton LEADS℠ hangtags were applied to 800,000 units of 100% cotton or cotton/spandex home textile products, including bedding, sheets, towels, etc. The products were available at approximately 800 stores across China.

GSCM staff worked with a Taiwanese denim manufacturer for a retailer’s TransDRY® technology and hangtag adoption. This adoption resulted in 10,000 units of TransDRY® technology denim product carrying the TransDRY® technology hangtags being made available for purchase at retail stores in Taiwan.
Marketing support was provided by GSCM staff for a leading Chinese underwear, sleepwear, and sportswear brand’s WICKING WINDOWS™ technology and hangtag adoption. This adoption resulted in the launch of a 29,000-unit WICKING WINDOWS™ technology program in the Chinese market. The underwear and tee shirts carry the WICKING WINDOWS™ technology hangtag.

GSCM staff worked to promote the adoption of a Cotton LEADS™ hangtag on a denim brand in Thailand. The Cotton LEADS™ hangtag will be on denim jeans distributed in the Thai retail market.

The Seal of Cotton licensing program continues to be strong in Latin America. Four new licensees were added during the first half of 2019, including one Mexican mass merchant who will increase the cotton composition in order to use the logo on a forecasted one million garments per year. On the other hand, two current retailer licensees, one in Mexico and another in Colombia, have expanded the use of the trademark to more product lines, which resulted in more polyester being displaced.

Additional trademark adoptions included:

- A U.S. brand/retailer was licensed to use the STORM COTTON™ technology trademark on accessories.
- A U.S.-based brand was licensed to use the Seal of Cotton trademark on 100% cotton bed sheets.
- A U.S.-based brand was licensed to use the Seal of Cotton trademark on 100% cotton home textiles.
- A U.S.-based brand was licensed to use the Seal of Cotton trademark on 100% cotton shower curtains.
- A U.S.-based brand was licensed to use the Seal of Cotton trademark on 100% cotton towels sold to the military.
- A U.S. brand was licensed to use the Seal of Cotton trademark on 100% cotton canvas bags.
- An Indian home textile manufacturer, selling products to U.S. retailers, was licensed to use the Seal of Cotton trademark on 100% cotton bed linens.
- A U.S.-based retailer was licensed to use the Seal of Cotton trademark on their 100% cotton sheets, towels, blankets, and shower curtains.
- A Taiwanese supplier of nonwoven products supplied 100% organic cotton tampons to a British tampon brand carrying the natural™ trademark. Products have been distributed in the British market since March 2019.

The Mexico City GSCM staff continued its marketing effort to promote cotton ideas through adoptions at retail and implementations at mills. A cotton innovation tour/meeting was conducted with five major Mexican retailers using cotton technologies, the FABRICAST™ collection, trend information, and consumer information to highlight the importance of product differentiation. The immediate result was that the largest department store in Mexico decided that the WICKING WINDOWS™ technology was a potential option for an upcoming activewear line. Also, the second largest department store thought that the non-resin TOUGH COTTON™ technology was an option for children’s pants.

Commercialization of cotton technologies also included:

- A leading U.S.-based work wear brand continued a line of men's performance fleece sweatshirts and pants featuring the STORM COTTON™ technology. Products are offered in retail stores and on their website.
- The TOUGH COTTON™ technology continues to be featured in school uniform pants and girls’ leggings at a major retailer. This program first launched in 2016.
- A leading U.S.-based casualwear brand commercialized 4,500 units of STORM COTTON™ technology sweaters for distribution in the U.S. and Canada for Spring/Summer 2019. They also commercialized around 20,000 units of STORM COTTON™ technology on woven pants for men for Fall/Winter 2019. The woven pants are available in the U.S. and Canada.
- A Japanese online retailer launched 20,000 units of TransDRY® technology tee shirts for the first half of 2019. Production was done in China by a large-scale apparel company with yarn treatment and fabric wet processing also done in China.
- A Taiwanese denim manufacturer and retailer commercialized 10,000 units of TransDRY® technology denim jeans for the Taiwanese market. Fabric was sourced from a licensed supplier in Taiwan.
- The Thai licensee of a U.S.-based jeanswear brand, continued with the production and sales of WICKING WINDOWS™ technology garments in the Thai market.
- A leading textile company in China developed 20 tons of STORM COTTON™ technology knitted fabrics for a U.S. sports and casual wear brand. About 20,000 pieces of hooded fleece jackets were produced for sale in the U.S. for Fall/Winter 2019.
• A U.S. workwear brand worked with a leading Chinese manufacturer to develop about 20,000 pieces of hooded fleece jackets treated with STORM COTTON™ technology. Products will be available in the U.S. market in Fall/Winter 2019.

• A U.S. underwear and casual wear brand worked with a Chinese manufacturer to commercialize around 36,000 units of TransDRY® technology tee shirts. Products will be distributed in the U.S. market for the Spring/Summer 2020 season.

• A U.S. undergarment and sleepwear brand produced 29,000 units of WICKING WINDOWS™ technology cotton tee shirts for distribution in Spring/Summer 2019. The products carried the WICKING WINDOWS™ technology hangtags and were available in the U.S.

• A Chinese underwear brand launched 500,000 units of men’s and women’s underwear treated with WICKING WINDOWS™ technology. The products are available in the Chinese market in 2019.

• A U.S.-based sportswear company launched 1,500 golf shirts treated with the SWEAT HIDING™ technology. The products were available in the U.S. and the U.K. in Spring/Summer 2019. Fabrics were sourced from a Hong Kong manufacturer with production in China.

• A leading Australia/New Zealand outdoor apparel brand placed a bulk order for 20,000 units of cotton/Cordura™ jackets, shorts, and pants, treated with the STORM COTTON™ technology.

Several brands and retailers that have adopted cotton technologies have continued those programs in 2019. One large lifestyle brand is continuing their STORM COTTON™ technology program and expanding by introducing STORM COTTON™ and Cordura® blended woven jackets. A large denim brand is continuing their TransDRY® technology program for the third year and volume is continuing to increase. A women’s sleepwear brand is continuing their program of TransDRY® in combination with antimicrobial filament, XT2®. A technical menswear brand released two STORM COTTON™ pants during the first half of this year.

Adoptions of cotton technologies included:

• A well-known U.S.-based brand/retailer launched the TransDRY® technology on 96/4 cotton/spandex polo golf shirts for women and is using the TransDRY® technology brand name.

• A high-end U.S.-based brand/retailer launched the SWEAT HIDING™ technology on 100% cotton mercerized polo golf shirts for men.

• A U.S.-based brand/retailer continues to run the TOUGH COTTON™ technology on 95/5 cotton/spandex girls’ leggings.

• A U.S.-based retailer continues to run the TOUGH COTTON™ technology on 95/5 cotton/spandex girls’ leggings.

• The STORM COTTON™ technology was adopted by a major U.S. brand in three styles of men’s 100% cotton sweaters and were at retail in the spring of 2019. The technology is promoted with the STORM COTTON™ technology trademark on the product hangtag and distributed through the brand’s company stores. Additionally, the STORM COTTON™ technology has been adopted by a U.S. menswear retailer for a quarter zip jacket to appear in stores in the fall of 2019. A major brand has adopted the STORM COTTON™ technology for men’s cotton/spandex slacks. This product will be in store in fall of 2019 and will include the STORM COTTON™ technology trademark on the product hangtag.

• A U.S. brand adopted the TransDRY® technology for a 100% cotton men’s polo shirt and men’s tee shirt. Both shirts launched online in mid-May 2019 and are promoted as featuring the TransDRY® technology. A women’s TransDRY® technology cotton performance tank top continues to be offered online by a tennis brand.

• Two major brands continue programs featuring the TOUGH COTTON™ technology for durable press boys’ 100% cotton uniform pants.

• PUREPRESS™ technology trial work has been conducted on bottom weight fabrications for a large apparel company and a childrenswear business. PUREPRESS™ technology trials on shirting fabrications were successfully conducted for a major brand. The PUREPRESS™ confidential disclosure agreement has been signed by a leading U.K.-based retailer.

• There is a high level of 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 German menswear company and a U.S. apparel company have signed confidential disclosure agreements. Trial work is being conducted on bottomweight fabrications on behalf of the large apparel company.

• A leading U.S.-based skate brand continued to grow their STORM COTTON™ technology fleece program this spring. Products are distributed in the U.S. and globally. They also released a STORM COTTON™ technology and Cordura® men’s jacket. Assistance was also given for a future release of WICKING WINDOWS™ technology knit shirts.

• Staff worked with a leading U.S.-based yoga brand on STORM COTTON™ technology trials for a program that will be launched in 2020.
An up and coming U.S. women’s sleepwear brand continued their program of a blend of TransDRY® technology with antimicrobial technology on sleepwear. The collection includes tops, bottoms, dresses, and jumpsuits.

There is continued developmental work for a major activewear brand to adopt TransDRY® technology for 2020. Asian staff is assisting with trials and implementation.

An American technical brand worked with a Taiwanese fabric manufacturer to adopt the STORM COTTON™ technology on pants. Products were distributed in the U.S. market.

A leading French based apparel brand worked with a knit fabric supplier in Bangladesh to develop STORM COTTON™ for fleece technology.

The same French-based brand worked with a Hong Kong woven fabric supplier to develop STORM COTTON™ and TOUGH COTTON™ technology fabrics for men’s bottoms.

A leading U.S. apparel brand worked with a sourcing company and a knit fabric supplier, both located in Hong Kong, to develop TOUGH COTTON™ technology fabrics for children’s leggings.

A leading U.S.-based casual wear brand worked with a Hong Kong sourcing company and a Hong Kong knit fabric supplier to develop 100% cotton French terry and 95/5 cotton/spandex jersey fabrics with the TOUGH COTTON™ technology.

A leading U.S. lifestyle brand worked with three woven fabric suppliers in China to develop cotton quilted fabrics, treated with the STORM COTTON™ technology for cotton luggage.

A leading Chinese textile mill developed STORM COTTON™ technology knitted fabrics for an international sports brand based in South Korea.

A leading textile company in China developed STORM COTTON™ technology woven fabrics for a U.S. department store chain.

A woven fabric manufacturer in Bangladesh adopted the PUREPRESS™ technology on bottom weight woven fabrics for a U.S. apparel company.

A European brand worked with a knit fabric mill in Thailand to develop STORM COTTON™ for fleece technology.

A Thai knit fabric mill worked at the request of a Japanese garment manufacturer to develop TOUGH COTTON™ technology (without resin) for knit fabrics.

A Thai denim fabric mill worked with a Thai casual brand on repeat orders for TransDRY® technology denim jeans.

The same Thai mill worked with a Japanese casual wear brand on new TransDRY® technology denim jeans for the Japanese market.

A fabric manufacturer in Hong Kong worked with a garment manufacturer in Hong Kong to offer STORM COTTON™ technology woven products to a U.S.-based online retailer.

A U.S. international clothing and accessory retailer worked with two suppliers in India to develop TOUGH COTTON™ technology woven fabrics.

A knit fabric manufacturer in Hong Kong successfully promoted STORM COTTON™ technology blister fabrics to a Canadian casual wear brand. The product has been requested for a hoody for the Canadian market.

A fabric convertor based in Hong Kong worked at the request of a Hong Kong sourcing company to develop STORM COTTON™ technology fleece fabric for a leading U.S. casual wear brand.

A knit fabric manufacturer in Hong Kong developed STORM COTTON™ technology fleece fabric for a U.S. clothing company.

A Hong Kong knit fabric manufacturer developed cotton/wool Sherpa following the specifications of the FABRICAST™ development.

A U.S. luggage and handbag design company worked with a leading textile company to produce 2,000 yards of TOUGH COTTON™ technology woven fabrics. Handbags would be produced for distribution in the U.S. markets.

A leading Chinese textile company adopted the SWEAT HIDING™ technology on knitted fabrics to market to their customers.

A key Canadian apparel brand worked with a Hong Kong trader to develop the TransDRY® and WICKING WINDOWS™ technologies on polos and tee shirts for distribution in Canada. Knitted fabrics were sourced from a Malaysian mill.

A U.S. sourcing company worked through a Hong Kong sourcing company and a fabric supplier in Pakistan to adopt PUREPRESS™ technology.

A leading U.S.-based outdoor apparel and casual wear brand worked with a fabric supplier in India to develop PUREPRESS™ technology on men’s woven pants for the U.S. markets.
A European men’s apparel brand worked with a Chinese woven fabric supplier to develop PUREPRESS™ technology shirting fabrics.

A large-scale vertical textile manufacturer adopted STORM COTTON™ technology on spacer knits for a U.S. retailer for men’s clothing.

One the world’s largest shirting fabric suppliers in China successfully adopted PUREPRESS™ technology to be marketed to high-end U.S. and European brands.

A well-known U.S. apparel brand worked with a large shirting fabric supplier in China to successfully adopt PUREPRESS™ technology on cotton shirting fabrics.

A medium-scale garment manufacturer coordinated the development of TransDRY® technology yarn-dyed denim pants for the Japanese arm of a U.S. casual wear brand. Both yarn treatment and fabric wet processing were done in China.

A Japanese women’s apparel brand adopted STORM COTTON™ technology on casual jackets. The woven fabrics were supplied by a licensed supplier from Taiwan.

Technical marketing and technical assistance are essential for helping companies bring cotton products to market. In the first half of 2019, several important activities were carried out to provide this type of technical assistance for marketing cotton:

- Staff assisted a U.S. brand/retailer implementing the STORM COTTON™ technology on 100% cotton accessories. Projected volume is one million+ pieces and will launch in 2020.
- Staff assisted a major U.S. brand that is running a trial using the TOUGH COTTON™ technology for knit shirts.
- Staff assisted a U.S. retailer with their adoption of the TOUGH COTTON™ technology for woven twill fabric. Estimated volume is 18,000 yards and is being run at a mill in Pakistan.
- Staff assisted a European-based retailer that will launch the STORM COTTON™ technology on knit and woven garments for sale in Fall/Holiday 2019.
- Staff assisted a U.S.-based manufacturer who would like to use the TransDRY® technology on mattress ticking.
- Staff assisted a U.S.-based brand on the development of the PUREPRESS™ technology for men’s pants.
- Staff assisted a major U.S. retailer in the development of woven dress shirts that hide sweat stains.
- Staff worked with a small men’s golf brand on the development of TransDRY® technology for golf shirts.
- Staff assisted an influential active / lifestyle brand with their adoption of the TOUGH COTTON™ technology that will launch in fall 2019. It will be marketed using the trademarked name.
- Staff is assisting a leading global outdoor brand with their performance cotton corporate initiative. They will be introducing several performance cotton products in 2020.
- Staff assisted a U.S. lifestyle brand with trials for the TOUGH COTTON™ technology which will be used in a girls’ legging program to launch in 2020.
- Staff assisted a U.S. retailer with trials for the TOUGH COTTON™ technology to be used in a girls’ legging program.
- A leading U.S.-based workwear brand requested assistance in conducting trials of the TOUGH COTTON™ technology at a Chinese mill for their jersey and fleece core fabrics. The brand will launch their TOUGH COTTON™ technology products in fall 2020.
- A leading global workwear brand requested assistance to develop TOUGH COTTON™ technology for knit fabrics. Staff provided assistance to run trials and testing at a mill in Mexico.
- Staff provided assistance in developing a dual performance fleece fabrication for a leading outdoor / lifestyle brand. The fleece fabrication has the STORM COTTON™ technology and Cordura® yarns to provide a water repellent fabric with improved durability.
- An outdoor brand developed the cotton jacquard blister knits from the FABRICAST™ collection through a Hong Kong fabric mill. These jacquard blister fabrics will replace the synthetic micro-fiber fabrics in their product line.
- Staff worked with a major outdoor brand to improve their yarn quality for digitally printed wovens.
- Staff provided technical assistance to one of the world’s leading shirting fabric suppliers in China to develop the PUREPRESS™ technology. The technology will be used for potential business development opportunities with international brands.
- Staff provided assistance to a medium-scale sock manufacturer to apply the TransDRY® technology to socks for a U.S. brand. Yarns were treated by a Taiwanese mill in their production facilities in China.
- Staff assisted a Taiwanese denim manufacturer and retailer to adopt the TransDRY® technology on knitted denim for a Japanese clothing brand. Details of fabric production were explained.
- Staff provided technical explanation to a Taiwanese woven fabric manufacturer on the PUREPRESS™ technology. The concept and production process for the technology was explained.
- Staff assisted a Taiwanese garment company to adopt STORM COTTON™ technology with a non-fluorine finish on cotton/Cordura knitted fabrics. The company had worked at the request of a U.S. casual wear brand.
- Staff assisted a Taiwanese printing factory to apply STORM COTTON™ technology with C6 finish on printed woven fabrics. A leading U.S. lifestyle brand requested that the factory work on the project.
- Staff provided technical support to a Pakistani vertical mill, from spinning to fabric printing, to develop the TOUGH COTTON™ technology, both with and without resin, on woven cotton fabrics.
- Staff provided technical assistance to a fabric converter based in Hong Kong to adopt the STORM COTTON™ technology for woven fabrics. They worked at the request of two major brands.
- Staff provided technical assistance to a leading Chinese textile company to apply the TOUGH COTTON™ technology on knitted fabrics for their U.S. workwear brand.
- Staff provided technical assistance on the PUREPRESS™ technology adoption to a textile mill in Bangladesh following the request from a U.S. clothing company.
- A textile mill in Hong Kong requested technical information on the TOUGH COTTON™ technology following requests from their customers to adopt the technology.
- Another textile mill in Hong Kong requested technical assistance to adopt the STORM COTTON™ technology following a request from a French apparel brand.
- Staff provided technical information to a Thai knit fabric mill on TransDRY® technology. They had worked on it at the request of a Japanese customer.
- Staff worked with a Thai spinning mill on the adoption of TransDRY® technology treated knit fabric for a garment factory in Mauritius. They had received orders from a European brand.

Nonwovens Marketing
The year 2019 is a good time to be marketing cotton in the nonwovens industries. Sustainability is a part of everyday business and the European Union is pushing regulations on single use plastic products. This will eventually include wipes and it may include disposable diapers and feminine hygiene products. Every part of this global supply chain is working on developing and utilizing raw materials that are natural, biodegradable, and recyclable as a solution to looming regulation. Consumers continue to become more conscious of the environmental impact of products they buy, which is providing opportunities for brands and retailers to modify their assortments to include more cotton products not just in Europe, but very strongly in Asia and in the Americas. The work in this division falls into these categories:

Market Development and Trademark Licensing
Cotton continues to gain popularity particularly in hygiene market applications including wipes, masks, diapers, and feminine hygiene around the world. While Asia may have led the way some years ago, brands in Europe and North America have caught on. Central and South America are the last to catch this trend but an important hygiene company in Colombia finalized a license agreement recently and another in Mexico is working on cotton developments. Cotton’s use in hygiene markets and other product categories that involve skin contact, in particular masks, expanded in the first half of this year.

The GSCM nonwovens team has worked in the first half of 2019 with some of the largest consumer goods companies in the world. This work has involved coordinating with teams in the U.S. and elsewhere. Some examples include a baby care team working on diapers and wipes in the U.S.; a feminine hygiene team in Switzerland; an R&D team working on soaps in Mexico; different R&D and marketing teams in the U.S. working on baby washes, lotions, creams, oils, and powders for global markets; a large mass market retailer on a new brand of baby diapers in the U.S.; and another global consumer product company marketing feminine hygiene products in Korea. The Asian markets were very active with licensee and program development in the first half of 2019.

Globalization is evident in our trademark licensing programs. In the first half of 2019, the GSCM nonwovens marketing group completed 18 new trademark licenses spanning the global supply chain: nonwoven roll goods manufacturers, converters, brands, and retailers. Products included wipes, tampons, pads, liners, diapers, baby lotion, cream, and wash. Companies were in 13 different countries: Australia, Belgium, Germany, Switzerland, U.K., U.S., Ukraine, Italy, Colombia, Indonesia, China, Korea, and South Africa, covering every continent excepting Antarctica. Four of these countries were new to nonwovens licensing: Colombia, Indonesia, South Africa, and Switzerland.
Market development has been more active with the top tier of global brands in baby care, feminine hygiene, and skin care than ever. This work is underway in the U.S., Asia, Europe, and Latin America. Markets like Brazil which have been more polymer-centric than any other market, are seeking out conversations about cotton. Colleagues in China, Hong Kong, and Mexico City have all been active in the first six months of 2019 with companies developing new products, requesting new licenses, submitting artwork for approval, and seeking input on new marketing and promotional activities, etc.

Marketing Communications
With a small team and global markets, a wide range of marketing communications platforms are used to help spread the news about cotton.

- Conferences and Trade Shows: In the first half of 2019, staff participated in four important events. In February, the GSCM division exhibited at TechTextil. This show encompasses the full range of technical textile applications. This was a first and it was successful for those working in traditional technologies as well as nonwovens. In March, Cotton Incorporated staff exhibited at the IDEA tradeshow, which is an important, global nonwovens tradeshow. In April, in Wuhan, China, staff attended CIDPEX, China’s largest conference for the hygiene markets. The conference was well attended by more than 600 industry professionals. GSCM staff gave a talk covering new market research on the global market for baby care and the company was honored as a sponsor. In June, at the World of Wipes conference, there was another opportunity to share the global baby care market research. Staff also chaired this international conference for the third year, served as a moderator, hosted a tabletop display, and scheduled meetings with key companies to promote the use of cotton.
- Trade Advertising: GSCM staff’s market development work spans entire supply chains for nonwoven products. It is essential to advertise in the important industry trade publications. The program includes print as well as digital media. In 2019, staff built upon the success of the 2018 divisional advertising campaign using a series of designs and messages that hit upon key division and industry topics including sustainability, cotton as natural fiber, cotton as safe for skin, and trusted by consumers.
- Social Media: In January, a well-known brand of swabs and cosmetic pads launched with Amazon. Social media support was coordinated with the brand to build awareness. In February, an influencer project was launched to build awareness for a global, baby care brand that was rolling out a new, innovative baby care product line containing cotton and branded to promote the value of cotton. Packages promoting cotton and containing the new products were sent to a select group of influencers with whom Cotton Incorporated has a relationship but did not pay for an endorsement. This new line was also promoted on fabricfourlives.com with a link to the brand’s website for purchasing. In addition, social media platforms were used as a part of marketing communications for events in which staff participated, such as conferences and tradeshows.
- CottonWorks™: Very early in the year, technical lectures 11 and 12 in nonwovens were rolled out and supported with social media. The next priority in 2019 was to update lectures 1 – 10 which were already on the CottonWorks™ website. By the end of the first half, lectures 1 – 6 were completed and launched. Updates for lectures 7 – 10 were specified and delivered to the graphic design company for production. Once completed, additional new lecture material is planned.
- Trade Public Relations: Cotton has received publicity nearly once a month in the first six months of 2019. Publications included Nonwovens Industry, AVR, Nonwovens Report International, Sustainable Nonwovens, and Household and Personal Care Wipes. Strong relationships have brought requests for input from journalists and editors.
- Research conducted in 2018 on the baby care markets in the U.S., Mexico, Brazil, U.K., France, Germany, China, and India was analyzed and compiled into material set for company and conference talks, a brochure, and advertisements. This body of work was first presented in April and will continue to be shared throughout the year at company meetings, conferences, tabletops, and in trade ads.

Technical and Innovation Development
The first half of 2019 was a busy time for new development and innovation, with some projects as continuations with new developments, while other projects are brand new.

- Innovative Product Development: Developments by a global brand to bring cotton in a powdered form to new baby care products has caught the attention of other global competitors in the market. One company has taken cotton flock and cottonseed oil into their lab to formulate new bar soaps. Results are promising and will be shared at a conference at the end of June.
Additive Manufacturing:
- Injection molding: Plaques, standard sized rectangles used for evaluating properties of the composite material, have been successfully formed with as much as 40% cotton. Some properties are sacrificed, others enhanced. The toothbrushes molded with cotton can be found on bogobrush.com. The cotton toothbrushes sold out in the Spring. Hangers for a large, important brand whose image is centered on sustainability and performance outerwear and activewear are under evaluation. The composite material contains cotton.
- 3D and additive printing: The 3D printing filament containing cotton has been developed and marketed. It has been out of stock for a couple of months and the producer and marketer is expecting the cotton flock to be supplied to them for replenishing inventory.

Sanitizing Wipes: The USDA has completed work on solving the problem of quats binding to cotton. This joint project is ready for prime time, but efforts to take to market have not been effective as neither the USDA nor Cotton Incorporated have the expertise, connections, and sales staff to dedicate to selling this concept into a very technical market. A consultant who has all the qualifications was hired. He ran a small market research project that came back with very positive results. Our next step for him in 2019 was to make appointments with key companies and decision makers and attend along with the USDA and Cotton Incorporated staff. He was unexpectedly offered a job he couldn’t turn down in the first quarter of this year. After getting his feet on the ground in this new assignment, he plans to explore interest by his new company in this technology.

Cotton Seed Oil Polymerization: By the end of 2018, it was determined that the work done thus far on this project was not patentable. Discussions began in the second quarter with NC State University and initial testing is underway. The hope is to formulate a project in the second half of 2019 for testing and evaluating cotton seed oil for coatings and films.

Fashion Marketing

In January, Fashion Marketing staff worked on the production of the Fall/Winter 2020/2021 season. Presentation, micro site, and materials all came out in the first part of 2019.

While finishing production for the Fall/Winter 2020/2021 season, staff was also starting initial production for Spring/Summer 2021. Production for Denim 2020/2021 continued the first half of the year with the presentation, micro site, and materials officially coming out in May and June of this year. Presentations will commence internationally in the summer of this year.

Production of Active Spring/Summer 2021 and Fall/Winter 2021/2022 was done and completed with the presentation, micro site, and materials officially coming out in May of this year. Already, the presentation has been taken to dozens of clients both domestically and abroad.

The Seasonal, Denim, and Active presentations were conducted across the U.S., Latin America, and Asia in the first half of the year, while multiple presentations continue to be held in the New York region. In the first half of the year, presentations have been seen in various cities in Mexico, China, Japan, Thailand, Korea, and Canada, as well as cities across the U.S.

Staff produced a specialized video for the Turkish market. A live presentation was recorded and subtitles added so that clients in Turkey could benefit from the key concepts of the Fall/Winter 2020/2021 forecast. This is also downloadable so that clients in the region can share with colleagues. Materials (color cards and swatch packets) were sent in conjunction with the presentation. This format will also be used for the Bangladesh market.

Staff continued with the bi-monthly travel blog. Cities/events featured were Amsterdam, Greenpoint Brooklyn, New York Fashion Week, Melbourne, The Armory Show, SXSW (South by Southwest) Austin, Auckland, Singapore, Taipei, Tokyo, and New York City.

The team did research both locally in New York City and abroad. Research was conducted in Austin, Melbourne, Auckland, Wellington, Berlin, Copenhagen, Milan, Lisbon, Seoul, Singapore, Taipei, Tokyo, and Bangkok.

Fashion Marketing staff participated in the Great Ideas in Cotton event in Hong Kong. They also gave a specialized denim presentation at New York Denim Days 2019. Staff also participated and made presentations to universities from around the country.
Strategic Objective 3: Conduct technical education and training to support cotton use.

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 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-three technical education workshops were held in the first half of 2019 with over 655 attendees. These individuals were from 281 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>
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<tbody>
<tr>
<td>Denim Manufacturing &amp; Garment Finishing</td>
<td>Cary, NC</td>
<td>10</td>
<td>31</td>
<td>4.9</td>
</tr>
<tr>
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<td>San Francisco, CA</td>
<td>9</td>
<td>17</td>
<td>4.0</td>
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<tr>
<td>Denim Wet Processing</td>
<td>San Francisco, CA</td>
<td>9</td>
<td>29</td>
<td>4.6</td>
</tr>
<tr>
<td>Functional Finishing</td>
<td>Los Angeles, CA</td>
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<td>20</td>
<td>4.8</td>
</tr>
<tr>
<td>Denim Wet Processing</td>
<td>Seattle, WA</td>
<td>5</td>
<td>16</td>
<td>4.8</td>
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<tr>
<td>Functional Finishing</td>
<td>Seattle, WA</td>
<td>10</td>
<td>43</td>
<td>4.6</td>
</tr>
<tr>
<td>Color Science &amp; Color Measurement</td>
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<td>39</td>
<td>4.3</td>
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<tr>
<td>Fabric Analysis - Knits &amp; Wovens</td>
<td>Shanghai</td>
<td>12</td>
<td>29</td>
<td>NA</td>
</tr>
<tr>
<td>Issues in Product Performance</td>
<td>Shanghai</td>
<td>12</td>
<td>32</td>
<td>NA</td>
</tr>
<tr>
<td>Denim Manufacturing &amp; Garment Finishing</td>
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<td>28</td>
<td>NA</td>
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<tr>
<td>Fabric Analysis - Knits &amp; Wovens</td>
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<td>28</td>
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<td>Issues in Product Performance</td>
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<td>18</td>
<td>24</td>
<td>NA</td>
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<tr>
<td>Denim Manufacturing &amp; Garment Finishing</td>
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<tr>
<td>Modern Printing Science</td>
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<td>45</td>
<td>4.9</td>
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<tr>
<td>ACTIVEWEAR: Performance Finishes</td>
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<td>22</td>
<td>31</td>
<td>4.5</td>
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<tr>
<td>Textile Fundamentals</td>
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<td>Fabric Analysis - Wovens</td>
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<tr>
<td>Issues in Product Performance</td>
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<tr>
<td>Denim Manufacturing &amp; Garment Finishing</td>
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<tr>
<td>Home Textiles</td>
<td>New York, NY</td>
<td>13</td>
<td>27</td>
<td>4.6</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 2019, two new nonwovens courses were added and new content pages on cotton biodegradability were also added. Additionally, hundreds of cotton fabrics from Cotton Incorporated’s FABRICAST™ collection were digitized and added to the updated FABRICAST™ collection page, and two new brochures were added: microfiber biodegradability in aquatic environments and NATURAL STRETCH™ technology. Over six news posts were also shared. In 2019 year-to-date, there were 29,956 registered users, 87,648 sessions, and 501,343 page views.

CottonWorks™ webinars offer a unique way to reach the industry and amplify our message. In the first half of 2019, one webinar was held. “Turning the Tides: Tackling Our Ocean’s Plastic Pollution Problem” included presentations on plastic pollution for the Plastic Leak Project and the latest research on microfiber degradation in aquatic environments. The webinar reached more than 326 unique participants. Over 700 individuals from more than 350 companies registered for the event. Webinars are one of the most successful methods to share information with a large number of industry professionals from the global cotton industry.
In 2019, the “Cotton in the Curriculum” 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 2019, 15 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. Fifteen professors learned the facts about cotton sustainability in a classroom setting and during a farm visit.

In April, staff hosted the Cotton Sustainability Summit, on behalf of the Importer Support Program. Over 60 sustainability decision makers gathered in La Jolla, CA to learn more about global issues as well as cotton sustainability. There were presentations on the new U.S. Cotton Trust Protocol, sustainable business strategies, ocean pollution, and general cotton production.
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
In the first half of 2019, the video First Day ran exclusively on television and was seen by 71% of women 18-49, 9.1 times. The commercial was also seen by 64% of men 18-49, 6.3 times and 76% of all adults 18+, 8.6 times.

Television
A total of 3,892 television exposures appeared across ABC, The CW, and FOX broadcast networks, and 11 cable networks (BET, Bravo, CMT, E!, Freeform, Food Network, HGTV, MTV, TBS, TLC, VH1). Units were scheduled during popular primetime programming such as The Masked Singer, 911, The Bachelor, Grey's Anatomy, The Good Doctor, American Idol, A Million Little Things, Jane the Virgin, Big Bang Theory, Real Housewives, Property Brothers, E! Red Carpet Coverage, and Chopped.

The commercials also ran on Roku, a video streaming service, to extend the reach of our campaign with younger audiences who are either light TV viewers or do not have traditional cable subscriptions. The video buy delivered an additional 5.7M+ impressions against women 18-34.

Digital Media
The Life is Uncomfortable digital campaign launched online in April. The four :15 second video assets (Tattoo, First Day, Meme, and Anchor) were distributed through video network partners on desktop, mobile, and tablet to build awareness and educate consumers about the style and benefits of cotton. The campaign utilized a two-pronged video strategy to extend campaign messaging when Cotton was on- and off-air with television advertising. The video campaign has garnered over 6M video plays through June.

The campaign was promoted through banner advertising on ad networks such as Undertone, Aki, and EMX Digital. This portion of the campaign launched in April and garnered over 36.3M impressions.

The campaign also utilizes an audio partner, Spotify, to tap into an audience that is always tuned in and looking to connect during all moments of their day. Since launching in May, Spotify has garnered approximately 656K impressions. In addition to standard banners and video, Spotify drove engagement through custom audio commercials and sponsored listening sessions.

Other digital tactics were used to drive campaign awareness and engagement with consumers. These campaigns garnered approximately 5.7M impressions. Banner ads, pre-roll videos, and native units drove users to TheFabricOfOurLives.com website.

Paid Search Engine Marketing (SEM)
Paid search advertising on Google and Bing continued to drive qualified visitors to TheFabricOfOurLives.com, resulting in over 285K clicks to the site. Of these clicks, 188K landed on the Shop Cotton web page, resulting in over 17K clicks on cotton-rich products to the respective retailers’ e-commerce websites. The top-performing paid search campaign continued to be Cotton Care, helping consumers in a time of need with cleaning and care tips. Keywords and ad copy were refreshed for all paid search campaigns for TheFabricOfOurLives.com, BlueJeansGoGreen.org and CottonToday.com.

Social Media
Paid and organic social media was used to reach and engage with users across platforms such as Facebook, Twitter, and Instagram. Messaging included Cotton program promotions, such as the Blue Jeans Go Green™ (BJGG) denim recycling program, fashion and lifestyle content, as well as cotton sustainability.

During the first half of 2019, a paid social media campaign promoted the Blue Jeans Go Green™ program on Facebook, Twitter, and Instagram. The campaign was optimized towards reaching as many unique people as possible and has already reached over 8.42M unique users and garnered more than 32.7M impressions to BlueJeansGoGreen.org to learn more. To date, the
The campaign has received 8,865 engagements (likes, comments, shares, etc.). The campaign will continue to run for the remainder of the year.

Jacey Duprie, a/k/a Damsel in Dior, signed on for her fourth consecutive year, as a brand ambassador for Cotton Incorporated. She is contracted to create Instagram posts, write blog articles, and produce a video, which will be distributed through both consumer and trade platforms.

Seventeen micro- and macro-influencers were contracted through an influencer agency and all influencers have begun creating content on behalf of Cotton through October. Their content will support key 2019 messaging pillars: Health and Wellness, Sustainability, and Denim, and will be shared across their own social pages.

TheFabricOfOurLives.com
There have been 700K+ visitors to TheFabricOfOurLives.com website, year-to-date; driven primarily by paid media efforts.

Production was completed on back-end optimizations on TheFabricOfOurLives.com, which enhanced technical performance and security.

A search engine optimization (SEO) audience analysis was conducted in February to validate audience segments and personas from the 2018 analysis and discover additional audience and interest segments to be explored for future campaigns. In March, SEM/SEO reports began to explore audience insights monthly, to inform paid search and paid social media, including the upcoming Know Your Clothes campaign.

The Department continued to write blog posts covering a range of fashion and lifestyle topics such as seasonal trends, wellness, and sustainability; always including corresponding cotton-rich shop items.

About 50 cotton-rich items were added to Shop Cotton per week, driving over 46K+ clicks to various retailers’ e-commerce websites year-to-date.

Production
Production was completed on the Health and Wellness campaign for digital and social media. The campaign consists of three :15 videos: Skin Irritation (hypoallergenic), Underwear (helps prevent yeast infections), and Sheets (better night’s sleep), along with nine social-specific assets, which are scheduled to go live on video pre-roll, social media, and Hulu during the second half of 2019.

The Department completed production on a competitive Know Your Clothes social media campaign. The campaign consists of three videos of varying lengths promoting cotton’s natural origins and competitive advantages, all while reminding consumers to “know their clothes.”

Production was completed on several photoshoots that generated over 15 images to be used on Cotton’s social media pages, websites, and banner ads. Using the images on Instagram allowed Cotton to “own the feed” with original photography. It created a clear brand voice and aesthetic, which is artful and purposeful, often highlighting cotton products and benefits as well as the cotton plant, in interesting ways.

Production began on new digital banner ads that will serve messages around health and wellness and denim. Over 40 unique banners will be created, targeting women and men 18-34 online. Production also began on two interactive banner experiences that contain quizzes for consumers to test their knowledge on fiber origins and denim facts, both driving to TheFabricOfOurLives.com to learn more.

Production was completed on several new trade assets, including a new Blue Jeans Go Green™ print ad; redesigned cottonseed digital banners and the development of a nutritionist-specific cottonseed banner; and ad resizes and translations for the China market.

Production began on two research projects: 1) An image and linguistics test related to cotton fields/plant imagery and social copy; 2) Quantitative and qualitative Gen Z research looking at their motivations/attitudes/behaviors related to sustainability and apparel.
Trade Media
A total of six macro trade print ads ran in the first half of 2019 in industry publications such as Textile Insight, Ecotextile News, and Rivet. The print campaign was complemented by digital banners on websites such as Ecotextile.com, WWD.com, SourcingJournal.com, and Rivet. Messaging included a variety of topics such as Seal of Cotton adoption, denim, commodity analysis, sustainability, and textile innovation.

A total of 18 nonwovens-specific print ads ran in the first half of 2019 in publications such as Nonwovens Industry, Nonwovens Industry China, Nonwovens Industry South East Asia, Nonwovens Report International, Household Care & Personal Wipes, AVR, and Sustainable Nonwovens. The print campaign was complemented by digital banner ads on websites such as Nonwovens-Industry.com and SustainableNonwovens.net. Messaging focused on cotton benefits and sustainability.

A total of 10 cottonseed-specific print ads ran in the first half of 2019 in publications such as American Dairymen, Dairy Herd Management, Dairy Star, Grain Magazine, Progressive Dairyman, 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, Feedstuffs.com, and Hoards.com. Messaging focused on cottonseed’s price.

A total of three Cotton LEADS™-specific print ads ran in the first half of 2019 in publications such as Ecotextile News. The print campaign was complemented by digital banner ads on websites such as Ecotextile.com and SourcingJournal.com. Messaging focused on sustainability, science, and leadership.

Public Relations
Support of Consumer Programs
The department worked with Strategic Alliances to provide public relations support and oversight on such consumer-facing initiatives as the Cotton + Revolve pop-up shop and various Blue Jeans Go Green™ program activities.

In collaboration with Strategic Alliances and their event agency, promotion of the Cotton + Revolve pop-up shop garnered 36 press mentions in widely-read media outlets such as, People and the Daily Mail. The total coverage reached an estimated 320.5M people and had an ad value of more than $602K.

Working in conjunction with BJGG program participants and, later in the spring, the external agency for the program, media coverage in widely-read media outlets such as The New York Times and the Washington Post reached an aggregate readership of nearly 453M with a combined ad value of more than $864K.

The department also assisted in developing and obtaining approvals for press releases and media alerts for the Blue Jeans Go Green™ program’s Spring College activation. The materials were developed with the help of student representatives from the schools.

Support of Trade-facing Programs
The Department provided media support for Global Product Supply Chain’s biannual Great Ideas in Cotton conference in Hong Kong. Three media outlets conducted interviews with spokespeople which were published and included additional articles on sustainability and transparency, or the company’s research on textile microfiber degradation in the same issue. Although the ad value is unavailable for Chinese trade outlets, the estimated total readership of this coverage is more than 177K.

Support of Sustainability Programs
Support of sustainability programs managed by other departments included the Importer Support Program/Global Product Supply Chain Cotton Sustainability event in La Jolla, CA. Two journalists from key media outlets attended the event and generated five related news items with a total readership of more than 321K. Public Relations also coordinated with the PR Department of a presenting retailer to capitalize on a sustainability announcement they made on the opening day of the event; thus, providing a mutually-beneficial media opportunity for the retailer and the event.

Public Relations deployed an animation highlighting company research on aquatic degradation of textile microfibers. Distributed over social media channels, the posts linked to a longform content on the research on www.CottonToday.com.

The Department also worked with the Sustainability division and external stakeholders to announce the company’s participation in a Pheasants/Doves Forever conservation program and coordinated the announcement of a new weed specialist that joined the staff.
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 denim adapting in an athleisure market, using technology to connect with consumers, shopping outlooks for 2019, and athleisure trends in 2019.

Public Relations has also shared videos produced by the CSPM department that features special data from the *Lifestyle Monitor™* survey. These videos, shared on the corporate social pages, focused on the extended size markets, the global denim market, and online shopping around the world.

The Department continued its editorial partnership with the Robin Report in 2019 with articles promoting the *Lifestyle Monitor™* survey and other analyses from CSPM, as well as cotton sustainability.

Public Relations also sponsored an industry-facing transparency survey with a trade media outlet. This included a published report on the findings and related webinar. CSPM did a concurrent consumer survey on the same topic, which was referenced in the webinar and resulting media.

Social Media

The department focused on organically growing their social media presence (separate from the consumer facing “Discover Cotton” pages). From January 1, 2019, through June 30, 2019, the trade Facebook page went from 10,300 followers to 10,803. This number of followers may appear small, especially relative to the consumer Facebook page, which has close to 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 first half of 2019, videos posted to the Facebook page garnered over 11.5K minutes viewed and 30.7K video views. The top videos during this time were: *Textile Microfibers & Degradation* (28,085 total reach; video posted two times), *Billy Carter – Cotton Research & Promotion Hall of Fame* (8,398 total reach), and the Cotton Board’s “The Farmer – Legacy” video (5,774 total reach).

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 – 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.

The department has also increased promotion of the CottonWorks™ website and FABRICAST™ collections across the social channels. The posts do particularly well on LinkedIn, but receive great engagement across all the channels.

Cottonseed Marketing

The department utilized its public agency for cottonseed and cottonseed oil to executed quantitative and qualitative surveys of influencers in the respective categories in an effort to identify knowledge gaps in current messaging. As a result, the department worked with Advertising to adjust the messaging of existing digital banner advertisements.

The department has also been active ‘on the ground,’ speaking at the National Cottonseed Products Association annual conference, meeting with stakeholders, attending key trade shows such as the snack industry event SNAXPO, and convening a panel of wholeseed influencers for a roundtable discussion.
Strategic Alliances

Consumer Sustainability Initiative: Blue Jeans Go Green™ Program

The Blue Jeans Go Green™ program shifted messaging at the start of the year to focus on the natural quality of cotton with an emphasis on ‘Creating Change with Cotton.’ Since authentic denim is made from cotton, a natural fiber, it can be recycled and used to create something new. Not only does the new messaging celebrate the insulation that’s made as a result of recycled denim, but it focuses on how cotton can help create a greener world. Updates were made to the BlueJeansGoGreen.org website and incorporated into all program materials.

In the first half of the year, a total of 25 contemporary brand and retail partners committed to recycling denim on behalf of the program. Ongoing consumer-facing retail partnerships include American Eagle Outfitters, Ariat, Levi’s, Madewell, ONS, and rag & bone. Some of the new partnerships established for select timeframes include Boot Barn, J.Crew Factory, FRAME, and Velvet by Graham & Spencer. These retailers offered incentives to their customers in more than 1.5K participating stores to recycle cotton and close the loop by keeping textile waste out of landfills. As a result, more than 300K pieces of denim were collected.

During the spring season, the Blue Jeans Go Green™ program partnered with students at Florida State University and the University of Cincinnati to install collection bins on each of their campuses and educate this demographic on cotton sustainability with a focus on denim recycling. Student groups on each campus educated their peers and ran denim collection drives through the end of April.

On June 8, Strategic Alliances launched a new collaboration between Cotton’s Blue Jeans Go Green™ program and Zappos for Good, the community outreach arm of Zappos.com. The collaboration makes recycling denim through Cotton’s Blue Jeans Go Green™ program easier than ever with prepaid mailing labels that can be downloaded by logging into a Zappos customer account. As the media lounge sponsor of Denim Days in New York City, in early June, the announcement was made during the festival, a 2-day indigo-soaked shopping event. The event saw approximately 3K attendees and there was great interest and engagement with the Blue Jeans Go Green™ activation.

The mail-in program continued to be a successful collection channel receiving over a thousand pieces of denim per month for recycling. In addition, several organizations throughout the country have contributed denim through the program’s Corporate Social Responsibility channel including Abercrombie & Fitch, Cone Denim, Harley Davidson, Phytogen, Unifirst, Vanity Fair, and more.

During the first half of the year, UltraTouch™ Denim Insulation was distributed to one grant recipient and more than six Habitat for Humanity affiliates some of which include Alexandria (VA), Greater Los Angeles, Wake County (NC), and Washington, DC.

Strategic and Retail Partnerships

The first half of the year saw the completion of a unique retail partnership with e-tailer, Revolve.

Revolve is an online fashion retailer and lifestyle brand that connects with the millennial consumer by providing premium trend-driven products from both emerging and established brands. Revolve has built its business on scrutinizing data, especially that derived from social media. Its social media footprint is substantial, with an Instagram following of 3.1M followers on Instagram alone. The retailer’s growth has been significant since its inception in 2003 and has amassed more than one billion in sales last year alone, leading to its initial public offering (IPO) in early June.

This spring, Cotton partnered with Revolve for an eight-week-long campaign that included a curated digital women’s collection, pop-up shop integration at the Revolve Festival, influencer content creation driving traffic, and awareness to @discovercotton, as well as efforts to educate consumers about the many benefits of cotton. This partnership allowed Cotton Incorporated to have a physical presence during festival season – a first for the organization. Revolve’s festival season is their biggest selling period of the year - greater than the holiday season.

The Cotton Shop on Revolve.com was live from March 25 through May 20. The curated online collection featured the season’s most-wanted styles and showcased the versatility of cotton, making it the most-wearable fabric for any shopper. The program was social media driven, with 16 fashion influencers participating in the program, amassing a combined total of 44M impressions. During the campaign timeframe, sales of cotton apparel on Revolve.com increased by 24%. Additionally, the program generated more than 99M impressions.
Corporate Strategy & Program Metrics

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 the attitudes of U.S. consumers toward cotton and competitive fibers, cotton made in the U.S., sustainability, denim jeans, back-to-school shopping intentions, and shopping preferences. In the first half of 2019, subject areas of research in the Lifestyle Monitor™ survey included, but were not limited to:

- Cotton Perceptions: Compared to manmade fiber clothing, the overwhelming majority of consumers say cotton clothing is the best for t-shirts (89%), childrenswear (83%), underwear and intimates (81%), and casual clothing (76%). Also compared to manmade fiber clothing, around 4 in 5 consumers say cotton clothing is the most comfortable (84%), softest (84%), most sustainable (82%), and highest quality (79%).
- Online Shopping: The majority of U.S. consumers prefer to research (63%) and browse (52%) clothing online, while less than one-third (29%) prefer to purchase their clothing online.
- Back-to-School Shopping: Among those with a need to do back-to-school shopping, more than 9 in 10 plan to buy clothes (93%), followed by supplies (88%), shoes (85%), fashion accessories (32%), electronics (27%) and sporting equipment (22%). Back-to-school clothing shoppers plan to spend an average of $312 (up 13% from 2018) on clothes per person.
- Denim Jeans: On average, U.S. consumers own 6 pairs of denim jeans. Nearly two-thirds of consumers (62%) say they wear denim jeans or shorts three times a week or more often.
- U.S. Cotton: The majority of consumers (52%) say it is important that the clothing they buy is "made in the U.S.A." Of those consumers who want their clothing made in the U.S., the majority say it is because they want to support the U.S. economy (71%) or because they believe clothing made in the U.S. is better quality (53%).

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. While second quarter data have been collected, they are currently being quality checked and prepared for analysis. Below are highlights from the first quarter 2019 results.

- Womenswear: Cotton’s share (weight basis) increased in 2 of the 5 major womenswear categories, knit shirts (+3.1 percentage points) and athletic apparel (+2.0 percentage points) while remaining flat for dresses (no change). Increases in cotton’s share of women’s athletic apparel were driven by increases in both women’s athletic bottoms (+2.7 percentage points) and athletic tops (+0.8 percentage points).
- Menswear: Cotton’s share (weight basis) increased in 2 of the 5 major menswear categories including athletic apparel (+3.7 percentage points) and knit shirts (+1.0 percentage points), while remaining relatively flat for pants (-0.1 percentage points). Increases in cotton’s share of men’s athletic apparel were driven by increases in men’s athletic tops (+7.0 percentage points).

Import Database
Staff updated the U.S., E.U., and Japanese import databases that provide key data on cotton’s share of apparel and home furnishing products imported into these countries. The updated databases will allow for more timely analysis of the data.

USDA NASS Database
Staff established user-friendly, Excel-based access to the complete set of USDA NASS data relating to cotton. This includes an extensive set of maps for use in future presentations.

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 first half of 2019, staff executed nearly 50 presentations and meetings on fiber economics and market research with key global industry contacts which included delivering domestic and global market intelligence presentations in mainland China, Hong Kong, Japan, Mexico, South Korea, and the U.S. Key topics included the cotton economic outlook along with consumer's
attitudes toward performance features, denim, sustainability, activewear, health and wellness, extended-size offerings, and retail and consumer updates. Together the economic and market research presentations had a total of 1,300 attendees. Below are a few highlights:

- Staff presented three economic presentations at the Beltwide Cotton Conferences. These included a cotton market outlook presentation at the general session, a research talk on the relationship between USDA condition and progress data and yield, as well as a cotton market outlook talk at an engineering session.
- A presentation on risk management and the cotton market outlook was presented to a group of Virginia growers.
- Staff provided an economic outlook presentation at a CCI trade fair in Cancun, Mexico. This meeting included over 150 representatives from the textile industry in the western hemisphere.
- Consumer and retail insight presentations were delivered in Mexico City, Mexico to seven brands, one textile manufacturer, and during a group presentation to over 80 representatives from the Latin American textile industry.
- Staff presented a Consumer and Retail Insights presentation to a graduate level textile class at NSCU.
- A consumer and retail trend presentation was delivered to over 130 attendees at the MAGIC Trade Show conference in Las Vegas, Nevada.
- Staff participated in a webinar panel hosted by Sourcing Journal to discuss the issue of transparency in the clothing industry. A total of 475 industry members listened to the webinar either live or registered to receive the audio and report link.

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:

- Six 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.
- Six issues of the Executive Cotton Update, which focus 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.
- Six 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 a 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
Supply Chain Insight: Intimates. Based on the results of the 2018 Intimate Apparel Study, an infographic was created and disseminated to key accounts and retailers and made available on Cotton Incorporated’s website. Key findings show the importance of fiber content to consumers, especially 100% cotton and cotton blends, for this wardrobe staple.

Video Insights.

- Online Shopping Around the World. Using data from the 2018 Global Lifestyle Monitor, this video explores how attitudes and behavior towards online clothes shopping vary by cultural context.
- Extended Size Market. With growing rates of obesity worldwide, this video, based on the results of the 2018 Extended Sizes Survey, showcases the demands of larger consumers for comfortable, stylish clothing to be widely available in their size.
- Denim Jeans and Evolving Fashion. Using data from the 2018 Global Lifestyle Monitor, this video highlights denim jeans’ place in consumer wardrobes as a fashion item to wear out to dinner and to work.

Lifestyle Monitor™ email. In collaboration with Public Relations, emails with trending topics from recent Lifestyle Monitor™ research are 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 Chinese Consumer Survey and Chinese Retail Audit
are ongoing market research studies conducted jointly by Cotton Council International and CSPM. The latest findings from these projects as well as additional results from other strategic research studies are provided.

Nonwovens Baby Care Research
CSPM conducted a survey of diapers and wipes purchasing and usage behaviors among 8,011 consumers in the U.S., U.K., India, Mexico, China, Brazil, Germany, and France to assess the importance of cotton in parents’ decision-making process. Highlights from the results include:

- Cotton is a familiar and trusted fiber that consumers connect with the attributes they most seek in diapers and wipes – namely comfort, hypo allergenicity, absorbency, and sustainability. 74% of consumers expect diapers and wipes to be made of cotton.
- Consumers use multiple brands of diapers and wipes simultaneously, using on average four diaper brands and five wipes brands either regularly or occasionally.
- Word-of-mouth recommendations from family and friends and from medical professionals (including samples provided by hospitals) have the greatest influence on consumers’ choice of diapers and wipes brands.

Transparency Research
CSPM conducted a survey of consumer attitudes about corporate transparency among 2,500 consumers in the U.S., U.K., Mexico, China, and Germany in order to understand how much consumers want to know about industry efforts toward sustainability. Highlights from the results include:

- Most consumers (77%) say it is important to them to know the environmental impact of the clothing they buy, and half (46%) think the clothing industry is doing this well. Consumers in Mexico (85%) and China (88%) are most likely to say that transparency is important and most likely to approve of the industry’s transparency.
- Consumers say they are willing to pay more for clothing they know is made in a sustainable way, with most (57%) saying they will pay between 1% and 20% more.

Chinese Consumer Survey
Below are highlights from the most recent results:

- Online Apparel Shopping: Nearly two-thirds of Chinese consumers (64%) say they shop for clothing online via their smartphone. Of those online shoppers, nearly all of them start shopping or browsing clothing online at ecommerce only websites (96%) like Tmall, followed by retailer or brand websites (38%) and social media sites (23%).
- Clothing Ideas: Chinese consumers continue to get their clothing ideas from a variety of places. Between one-third and two-thirds of Chinese consumers say they get their clothing ideas from their friends and colleagues (67%), family members (62%), in-store and window displays (53%), sales persons in-store (45%), and retailer/brand or ecommerce websites (35%).
- Cotton Preferences: Cotton remains the most preferred fiber among Chinese consumers. At least 2 out of 3 Chinese consumers say they are bothered by brands that may be substituting synthetic fibers in their underwear (76%), bed sheets (75%), bath towels (69%), socks (69%), t-shirts (65%), dresses (64%) and dress shirts (63%). In addition, the majority of Chinese consumers are willing to pay a higher price to keep cotton from not being substituted in their underwear (82%), bed sheets (78%), bath towels (69%), socks (56%), t-shirts (63%) dresses (52%), and dress shirts (54%).

Chinese Retail Audit
Below are highlights from the most recent results:

- Cotton’s share (weight basis) of major menswear product categories audited in Shanghai and Xi’an, China stood at 74% in 2019, down slightly from 2018 (75%).
- Over the past year, cotton’s share increased for men’s jeans (84% up from 82%) and woven tops (80% up from 79%).
- Cotton’s share (weight basis) of major womenswear product categories audited in Shanghai and Xi’an, China stood at 58% in 2019, up slightly from 57% in 2018.
- Over the past year, cotton’s share increased in women’s knit tops (71% from 62%), woven tops (61% from 58%), and activewear (37% from 32%). Cotton’s share for women’s denim jeans remained flat at 85%.
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 first half of 2019.

### Trade

<table>
<thead>
<tr>
<th>Date</th>
<th>Event</th>
</tr>
</thead>
<tbody>
<tr>
<td>January 23, 2019</td>
<td>2018 Cotton Biotechnology Award Recipient – Dr. David M. Stelly</td>
</tr>
<tr>
<td>January 25, 2019</td>
<td>Jordan Elected New Cotton Incorporated Chairman</td>
</tr>
<tr>
<td>June 17, 2019</td>
<td>Gaylon Morgan Appointed Research Director for Agricultural &amp; Environmental Research Division at Cotton Incorporated</td>
</tr>
</tbody>
</table>

### Print Coverage

The following is a list of some of Cotton Incorporated’s print coverage in the first two quarters of 2019.

- The Corn and Soybean Digest: Mention of Cotton Incorporated
- Toronto Star: Mention of Cotton Incorporated
- Manhasset Press: Mention of the Blue Jeans Go Green™ Program
- Richmond Times Dispatch: Mention of Cotton Incorporated
- The Denver Press: Mention of Cotton Incorporated

### Television and Radio Coverage

The following is a partial list of Cotton Incorporated’s television and radio coverage in the first two quarters of 2019.

<table>
<thead>
<tr>
<th>Station</th>
<th>Affiliate</th>
<th>Market</th>
<th>Topic</th>
</tr>
</thead>
<tbody>
<tr>
<td>My Lubbock TV</td>
<td>MyNetworkTV</td>
<td>Lubbock, TX</td>
<td>Mention of the Blue Jeans Go Green™ program</td>
</tr>
<tr>
<td>FOX 34</td>
<td>Fox</td>
<td>Lubbock, TX</td>
<td>Mention of the Blue Jeans Go Green™ program</td>
</tr>
<tr>
<td>FOX19 Now</td>
<td>Fox</td>
<td>Cincinnati</td>
<td>Mention of the Blue Jeans Go Green™ program</td>
</tr>
<tr>
<td>RFD-TV</td>
<td>Rural Media Group</td>
<td>National/Syndicated</td>
<td>Mention of Cotton Incorporated</td>
</tr>
<tr>
<td>AM790/WNIS</td>
<td>Fox</td>
<td>Norfolk, VA</td>
<td>Mention of Cotton Incorporated</td>
</tr>
<tr>
<td>KTVK</td>
<td>Independent</td>
<td>Phoenix, AZ</td>
<td>Mention of Cotton Incorporated</td>
</tr>
<tr>
<td>FOX 8</td>
<td>Fox</td>
<td>Cleveland, OH</td>
<td>Mention of the Blue Jeans Go Green™ program</td>
</tr>
<tr>
<td>KXTQ-FM Online</td>
<td></td>
<td>Lubbock, TX</td>
<td>Mention of youth marketing program</td>
</tr>
</tbody>
</table>

### Internet Coverage

The following is a partial list of the online mentions of Cotton Incorporated, or its initiatives or programs, in the first two quarters of 2019.

- Refinery29: Mention of the Blue Jeans Go Green™ program
- Martha Stewart Living Online: Mention of the Blue Jeans Go Green™ program
- American Eagle Blog: Mention of the Blue Jeans Go Green™ program
- Just-style.com: Mention of the Blue Jeans Go Green™ program
- PGA Magazine Online: Mention of Cotton Incorporated
- The Kitchn: Mention of Cotton Incorporated & quote from Suzanne Holmes
- Cotton Grower – Online: Mention of Cotton Incorporated
- Delta Farm Press: Mention of Cotton Incorporated
- Southeast Farm Press: Mention of Cotton Incorporated
- Southwest Farm Press: Mention of Cotton Incorporated
- Agri Marketing Online: Mention of Cotton Incorporated
- No-Till Farmer Online: Mention of Cotton Incorporated
- Growing Alabama: Mention of Cotton Incorporated
<table>
<thead>
<tr>
<th>Source</th>
<th>Mention of Cotton Incorporated</th>
</tr>
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<tbody>
<tr>
<td>Ohio Farmer Online</td>
<td></td>
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<tr>
<td>Real Simple Online</td>
<td>Mention of Cotton Incorporated &amp; quote from Suzanne Holmes</td>
</tr>
<tr>
<td>HowStuffWorks</td>
<td>Mention of Cotton Incorporated</td>
</tr>
<tr>
<td>Better Homes and Gardens Online</td>
<td>Mention of Cotton Incorporated</td>
</tr>
<tr>
<td>KOMU-TV Online</td>
<td>Mention of Cotton Incorporated</td>
</tr>
<tr>
<td>TravelGrom</td>
<td>Mention of Cotton Incorporated + Revolve Partnership</td>
</tr>
<tr>
<td>Innovation in Textiles</td>
<td>Mention of Cotton Incorporated</td>
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<tr>
<td>Nonwovens News</td>
<td>Mention of Cotton Incorporated</td>
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<tr>
<td>High Plains/Midwest Ag Journal Online</td>
<td>Mention of Cotton Incorporated</td>
</tr>
<tr>
<td>California Apparel News Online</td>
<td>Mention of Cotton Incorporated</td>
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<tr>
<td>FashionMag.com</td>
<td>Mention of the Blue Jeans Go Green™ program</td>
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<td>Fibre2Fashion</td>
<td>Mention of the Blue Jeans Go Green™ program</td>
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<tr>
<td>Her Campus</td>
<td>Mention of the Blue Jeans Go Green™ program</td>
</tr>
<tr>
<td>Ecotextile News</td>
<td>Mention of Cotton Incorporated</td>
</tr>
<tr>
<td>Haute Living</td>
<td>Mention of Cotton Incorporated &amp; Revolve program</td>
</tr>
</tbody>
</table>
The Corporate Administration Division includes Board of Director Services, Human Resources, Corporate Office and Facility Services, and Intellectual Property, Contracts and Legal Departments.

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

New Board Members participated in a Multi-Region Producer Tour February 18, which included a tour of the World Headquarters in Cary, NC, and presentations by staff and representatives from the Cotton Board. The second day of the Orientation focused on specific topics related to the Board of Directors, such as USDA oversight of the Program, Accounting procedures, an overview of the Board structure, and training for the dedicated Board of Directors Web site.

The Board held an Executive Committee Meeting in Del Mar, CA, March 4-6, in conjunction with the Cotton Board’s meeting. The Cotton Incorporated Executive Committee participated in many of the Cotton Board sessions, including Program Committee meetings, the General Session, and the Business Session.

The Officers of Cotton Incorporated and the Cotton Board held a joint Board Strategic Planning Session in Chicago, IL, April 3-4. Topics of discussion included key issues affecting cotton markets and demand, sustainability strategy, future budgets, capital equipment needs, and cottonseed marketing.

In addition, the Cotton Incorporated Board of Directors held a Directors Meeting June 11-13, in Dallas, TX, in conjunction with Cotton Board Members. The key objectives of the meeting were for management, staff, and Board Officers to:

- Provide Updates on 2019 Program Activities
- Present 2020 Budget Framework for Discussion and Board Recommendation
- Present 2018 Actual-to-Budget Report
- Provide a Response to the Cotton Board’s Program Recommendations

### COTTON INCORPORATED
### BUDGET DATA THROUGH JUNE 30, 2019

<table>
<thead>
<tr>
<th>Program Area Expenditures</th>
<th>Budget</th>
<th>Actual</th>
</tr>
</thead>
<tbody>
<tr>
<td>Agricultural Research</td>
<td>$13,245,000</td>
<td>$2,434,000</td>
</tr>
<tr>
<td><strong>Research &amp; Development</strong></td>
<td></td>
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<tr>
<td>➢ Fiber Competition</td>
<td>$4,623,000</td>
<td>$1,916,000</td>
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<tr>
<td>➢ Product Development &amp; Implementation</td>
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<tr>
<td><strong>Total</strong></td>
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<td>Consumer Marketing</td>
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<tr>
<td>Corporate Administration</td>
<td>$5,431,000</td>
<td>$2,598,000</td>
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<tr>
<td><strong>TOTAL</strong>:</td>
<td>$82,025,000</td>
<td>$33,073,000</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.

**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**

**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.

**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 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.

**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.

**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.

**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 Development and Implementation**

**Agricultural and Environmental Research (AERD)** – A team of scientists that provide research and technical services to cotton growers, ginners and their support industries. The department is also a link between cotton production, the textile industry, and the research and extension communities.

**DeltaE (ΔE):** Delta represents a Greek letter often used to denote difference, and E stands for Empfindung; German for “sensation.” This equation is being used to describe the difference between two colors by using the International Commission on Illumination’s (CIE) CIE L*a*b* graph; defining a Delta E of (one) as barely perceptible and a Delta E greater than (three) as two different colors.

**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):** A data set developed by AATCC Committee RA88, Home Laundering Technology, established to develop a consistent set of test conditions for all test methods involving home laundering.

**Industry Associations:** Cotton Incorporated maintains a presence and membership in several leading industry associations.

**AATCC** – American Association of Textile Chemists and Colorists

**ASTM International** – consensus-based standards organization, committee D13 covers most textile standards

**SAC** – Sustainable Apparel Coalition

**ISP Programs:** Technical education workshops 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 classes and are heavily involved in the development of workshop materials.

**Life Cycle Assessment (LCA):** A technique to assess 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).

**Noil:** Short strands and knots that combed out of natural fiber before spinning.

**Polyactic Acid or Polyactide (PLA):** A thermoplastic aliphatic polyester derived from renewable biomass, typically from fermented plant starch such as from corn, cassava, sugarcane or sugar beet pulp. In 2010, PLA had the second highest consumption volume of any bioplastic of the world.

**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 and Implementation (PDI):** The textile research division within Cotton Incorporated that consists of Fiber Processing, Product Development, Textile Chemistry Research, Technical Services and Implementation, and Product Integrity.

**Product Development Laboratory (PDL):** This laboratory houses knitting 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 may threaten cotton’s market share, as a liaison with other divisions on matters related to sustainability and supports the Chemical Hygiene Officer to ensure a safe working environment for the researchers.

**Shibori Dyeing:** A labor-intensive dyeing technique, originating in Japan during the eighth. This technique is a form of resist dyeing that involves shaping and securing fabric before dyeing to create patterns. Traditionally done using Indigo.

**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, provide technical services, and support the marketing efforts of those technologies.

**TEMPO Oxidation:** 2,2,6,6-Tetramethylpiperidine-1-oxyl radical (TEMPO) is a stable and commercially available organic free radical reagent used to oxidize primary alcohols to aldehydes. Selective oxidation of primary alcohols is possible since secondary alcohols are much less reactive under these conditions.

**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, 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.

**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.

**Initial Public Offering (IPO)** - or stock market launch is a type of public offering in which shares of a company are sold to institutional investors and usually also retail (individual) investors. An IPO is underwritten by one or more investment banks, who also arrange for the shares to be listed on one or more stock exchanges. Through this process, a privately held company is transformed into a public company.

**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 number 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.