SOUTHERN REGIONAL RESEARCH CENTER

ENHANCING VALUE AND GROWING THE FUTURE

RESEARCH ACCOMPLISHMENTS

1941 – 2016

USDA

United States Department of Agriculture

Agricultural Research Service
Southern Regional Research Center

This booklet contains a general summary and a sampling of remarkable accomplishments of SRRC research with significant economic impact that have benefited US Agriculture and individuals globally. The accomplishments are summarized from patents, peer-reviewed articles as well as popular articles, and are presented by decade, spanning the 1940s to present.

Research results from the Southern Regional Research Center contribute to improving our quality of life, enhancing the value of agricultural commodities, along with having a positive global influence. Products produced have helped create thousands of industry jobs and make life healthier, safer, more convenient and better tasting.

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SOUTHERN REGIONAL RESEARCH CENTER
A DECADE OF RESEARCH IMPACTS – 1940s

1941 – YIELDING FIRMER PICKLES. Fermentation of cucumbers to yield pickles sometimes results in the formation of "bloaters" and soft pickles. Scientists associated with the Southern Regional Research Center determined the causes for these problems and developed processes for helping to produce firmer pickles.

1943 - COCOA BUTTER FROM COTTONSEED OIL. Cocoa butter, from which chocolate candy is made, has the unique characteristic of being solid at room temperature but of melting when placed in the mouth. Scientists at the Southern Regional Research Center chemically modified cottonseed oil giving it properties similar to that of cocoa butter. The process was patented in 1969; work continued in the 1990s with SRRC chemical engineers finding a way to enzymatically make a cocoa butter like product from cottonseed oil and sunflower oil. These new confectionery fats can replace pure cocoa butter in 90% of its uses and is used by the candy industry.

1944 – COTTON PROTECTIVE TREATMENTS FOR OUTDOOR APPLICATIONS. Weather protective treatments for cotton fabrics have found extensive application in tents, tarpaulins, and covers for sand bags. SRRC scientists developed processes for treating cotton that assisted in protecting these fabrics from sunlight degradation, mildew and algal attack. One of these finishes includes copper fungicides for mildew and rot resistance and has found extensive and continuing use over the years.

1945 – WATER REPELLENCY FOR TENTS, FIRE HOSES. A type of impermeable fabric, called self-sealing fabric was the subject of early work at SRRC. The uses of these fabrics were in tentage, water bags and fire hoses. Research thrusts included preventing the passage of water through cloth by treating the fibers with hydroxyethylcellulose to give a permanent finish that swelled when wet.

1945 – COTTON STRETCH SURGICAL BANDAGES. Research at SRRC produced unique products from slack mercerization. The invention of the cotton stretch bandage revolutionized the surgical bandage concept. SRRC scientists patented a method of producing cotton surgical gauze that contained crimps and kinks which produced not only increased shrinkage, but an easily stretchable gauze that clings rather than loosens in place. With improved elastic properties, cotton gauze bandages are substantially more efficient when used to cover wounds on movable parts of the body and are still used today. Later, concepts of comfort and action stretch became important to consumers of the tight fitting garments of the 1960s.

1945 - COTTON TIRE CORD. Before the introduction of high-strength rayon, nylon, and polyester into vehicular tire cord, cotton was used for this purpose. In order to increase the useful lifetime of these tires, simple ways to control the stretch and breaking strength of cotton cord according to industrial requirements were developed by scientists at the Southern Regional Research Center.

1946 - FROZEN ORANGE JUICE CONCENTRATE. Oranges were once a surplus seasonal crop mainly in Florida. The Winterhaven field station of the Southern Regional Research Center helped perfect a method to produce a practical concentrate that could

be frozen and reconstituted into a flavorful drink with its vitamins and minerals intact. This provided a market for the surplus crop and fresh tasting orange juice for the entire country throughout the year. The process led to the expansion of the Florida citrus economy as well as surrounding industries for transporting and warehousing the juice. And so the frozen concentrated orange juice industry was born. Today, consumption of orange juice from concentrate is over 1 billion gal/year in the U.S. alone. In addition, 15.3 M gallons are exported annually. The annual retail value of orange juice is more than $3 billion. The process used is still basically the one developed at SRRC.

1947 – SUGARS FOR CANDY. Processes were developed for making specialized sugars for the candy industry. Turbinado sugar was made directly from cane juice during harvest without refinement. Sugar that was whiter and purer than turbinado was also produced proving perfect for pale-colored candies like mints.

1948 – EFFICIENCY IN SUGARCANE PROCESSING. SRRC research proved to sugarcane growers and the processing industry that losses result from delaying milling. Fresh cane, delivered to sugar mills immediately after harvesting, yields more recoverable sugar than cane left lying in the fields after cutting.

1949 – DETECTION METHODS FOR GOSSYPOL IN COTTONSEED. Gossypol is a toxic yellow pigment that is scattered throughout the kernel of a cottonseed. While cattle can eat cottonseed meal containing gossypol, it is unsuitable for feeding poultry and swine. A major goal of SRRC research has been to expand the market for animal feeds by getting rid of gossypol. The first step in this effort was the development of analytical standards in measuring and detecting gossypol in cottonseed materials. The developed methods for analysis of cottonseed for gossypol have been adopted and used throughout the world.

SOUTHERN REGIONAL RESEARCH CENTER
A DECADE OF RESEARCH IMPACTS – 1950s

1950 – MANUFACTURE OF PEANUT PROTEIN PRODUCTS. To diminish the surplus of peanuts, research chemists developed new industrial uses for peanut meal and protein. Some of the peanut protein products were glues, coatings for paper, a fire-extinguishing liquid, and sizing for paper and textiles. Chemists even made a textile fiber from peanut protein. Called Sarelon, it was soft and blended well with rayon or wool. It enjoyed a brief commercial existence before being replaced by synthetics.

1951 – NAVAL STORES RESEARCH REVOLUTIONIZED TURPENTINE PROCESSING. Throughout the South, farmers stopped using antiquated and dangerous fire stills, substituting SRRC's steam still for separating turpentine and rosin from pine gum. The turpentine that flowed from the new tills was clear as water and of high quality. The product improvements were accompanied by a new system of evaluating pine gum, resulting in higher cash income for farmers.

1952 – COTTONSEED SOLVENT EXTRACTION PROCESS called filtration-extraction was introduced by SRRC scientists to update oil processors' outmoded equipment of hydraulic and screw presses. It was the first of several new extraction procedures devised in the next 10 years. Solvent extraction is widely used throughout the world today for many different oilseeds.

Many of the most useful inventions developed in New Orleans were instruments and procedures for testing cotton fibers. New varieties of cotton and new methods of harvesting and ginning caused wider variations in cotton quality. Faster spinning speeds in textile mills made it more important to know the significant properties of cotton in each bale. With this in mind, SRRC scientists developed the following instruments:

> **1952 – FIBROGRAPH** for measuring fiber length and length distribution was developed with speed and economy.
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> **1953 – STELOMETER** for measuring the strength and stretchability of bundles of cotton fibers was another tester and method that was developed at SRRC.
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> **1954 – NEPOTOMETER** was developed to predict the neppiness of cottons. Neps are the small knots of tangled fibers that form during processing. They are tough to remove and cause poor fabric quality.

1953 – PLASTICS AND EMULSIFIERS FROM ACONITIC ACID. Aconitic acid is a nonsugar component in Louisiana sugarcane blackstrap molasses. SRRC scientists patented the method for extracting aconitic acid from sugarcane and once the separation process was perfected, the researchers demonstrated that chemicals derived from aconitic acid could be used in molding transparent plastic materials and as wetting agents in emulsions and cleaning compounds. Costs of recovering the acid from the blackstrap proved low in relation to the financial returns from sales.

1953 – FLAME RETARDANT FINISHES FOR COTTON. Initial work at SRRC to develop flame retardant finishes for cotton was directed at bedsheets, since fires from smoking in

bed caused many deaths each year. A chemist in the Southern laboratory discovered a compound named THPC for short. Cotton fabric treated with THPC did not flare up when held in a flame; it formed a tough black char that retained its fiber structure and strength when burned and survived laundering and dry cleaning. It was used first in military combat clothing, firemen's uniforms, and hospital linens and uniforms.

1955 – EMULSIFIERS, PLASITICIZERS, AND COATINGS FROM OILSEED CROPS. Surplus in many oilseed crops led to finding new uses for vegetable fats and oils. Scientists at the Southern Regional Research Center discovered that replacing two fatty acids from an ordinary fat or oil molecule with acetic acid groups yielded a new group of chemicals they called acetoglycerides. Some of these new compounds can be formed into thin, stretchable films for a variety of uses in the food and cosmetic industries. Since the films are edible, they can be used harmlessly as lubricant on machinery that comes in contact with food. They are also useful as release agents, emulsifiers, plasticizers, and coatings to retard oxidation and moisture damage. Eastman Chemical and five other manufacturers sell over 1,000 tons annually in the U.S.; they are also produced in four foreign countries.

1955 – SOAPS FROM COTTONSEED. Cottonseed oil foots are the settlings from stored crude cottonseed oil. SRRC scientists redoubled efforts to develop new products from cottonseed oil and foots were used to make soap. Researchers also found that treatment with wood alcohol turned the foots into a methyl ester product, that was marketed as an additive for high-protein feed.

1955 – EDIBLE RICE BRAN OIL. Rice bran, a waste product of rice milling, was found to contain edible oil that could be easily extracted. This discovery led to added income for the rice farmer and increased the nation's supply of food oil.

1956 – DYEING PROCESSES FOR NOVEL COTTON FABRICS. SRRC chemists experimented with ways to color cotton by modifying the fibers so they would chemically react with synthesized dyes. These experiments led to commercial development of several fiber-reactive dyestuff groups, sold under various tradenames. The process provided textile mills with the means to dye cotton in bright new shades with excellent color fastness and helped improve cotton's competitive market position.

1957 – OPENER-CLEANER FOR EFFICIENT CLEANING OF COTTON. With the growth of mechanical harvesting, cotton contained more trash, and cleaning it became more difficult. Patented by SRRC engineers in 1957, the opener-cleaner combined the steps of opening bales and blending cotton with more efficient cleaning, producing a smoother spinning lint. It could process 1,600 lbs of cotton per hour. The first machines were installed in mills within a year, and manufacturers reported saving of up to $100 a day per machine. Farmers benefitted because the opener-cleaner expanded the use of lower grades of cotton.

1958 – WASH-AND-WEAR COTTON DEVELOPED. After WWII cotton markets were usurped by synthetics. Untreated cotton fabric wrinkles upon laundering and requires ironing. Synthetic fibers such as polyester threatened cotton's share of the market because these synthetic fabrics did not require ironing. To preserve the U.S. cotton industry, SRRC chemists and engineers launched a broad based research campaign to develop chemical treatments and processes that produced the first wash and wear cotton

clothing made from a new blend of 35% cotton with 65% synthetics. These garments had permanent creases and required no ironing after washing.

1959 – GRANULAR CARD, THE NEXT BIG INVENTION IN COTTON PROCESSING. Its purpose was to brush, clean, disentangle, and straighten the cotton fibers before spinning them into yarn. SRRC's granular card cut cotton waste in half. Since it was a sealed unit, it also eliminated a major source of cotton dust in textile mills. The machine was an instant success with 24 firms licensed to manufacture it and 2,500 cards installed within 6 years after its invention.

The Southern Laboratory made uncounted improvements in cotton processing … from better machinery, smoother more efficient processes to innovative testing equipment. These developments helped save the U.S. cotton industry.

SOUTHERN REGIONAL RESEARCH CENTER
A DECADE OF RESEARCH IMPACTS – 1960s

1960 – DEHYDRATED SWEET POTATO FLAKES. Sweet potatoes grow in many shapes and sizes, some too large or misshapen for the fresh or canning market. SRRC researchers found a use for these odd-sized potatoes by developing a process to produce dehydrated sweet potato flakes. Addition of hot water yielded mashed sweet potatoes. The product has been used for school lunches and for military use overseas, as well as for other institutional purposes.

1960 – TEST METHOD FOR FROMALDEHYDE IN TEXTILES. Throughout the years, SRRC has been a leader in research to quantify formaldehyde evolved from textiles. Work by scientists provided a basis for the AATCC Test Method 112.

1962 – IMPROVED DEHYDRATED CELERY. Dehydrated vegetables for use as seasoning are very popular. One problem is loss of flavor intensity. Scientists at the Southern Regional Research Center improved the quality of dehydrated celery by adding freezing and explosion puffing steps to the conventional process.

1963 – HIGH CALORIE INTRAVENOUS FAT EMULSION. Patients recovering from serious wounds or surgery, and who have to be fed intravenously for long periods, often lose weight. In many cases the patient has difficulty eating the required extra calories needed to hasten recovery. SRRC chemists developed a high-calorie, fat emulsion for intravenous feeding composed of purified cottonseed oil and egg lecithin as the emulsifier. The emulsion was originally used by the military during the Korean and Vietnam Wars and now is used by many hospitals for postoperative care.

1963 – FIBER RETRIEVER FOR CLEANING COTTON FIBERS. Engineers at the Southern Lab invented this inexpensive device that increased efficiency of the cleaning section of the card by 40%. It also removed a high percentage of short cotton fibers and decreased the loss of spinnable fibers, thus improving yarn strength and uniformity. It was quickly welcomed by industry with more than 20,000 retrievers in use within 3 years.

1965 - ALL COTTON DURABLE PRESS COTTON GARMENTS. New Orleans scientists refused to settle for clothing limited to only 35% cotton. Contending that garments of all-cotton were more durable and comfortable than those made from the blend, they increased their research efforts. And by 1965, they succeeded in new chemical finishing and crosslinking agents to make fabrics last longer and resist wrinkling. Consumers have been able to buy all cotton garments that are durable yet look newly pressed after repeated launderings and dryings. Today durable press textiles are providing an annual market for an estimated 2.5 million bales of cotton that otherwise would not be sold.

1965 - AFLATOXIN DETECTION IN COTTONSEED. Aflatoxin is a potent carcinogen created by molds that can grow on cottonseed and other commodities under certain environmental and storage conditions. In the 1960's, the presence of aflatoxin in cottonseed emerged as a serious problem to cottonseed processors, who were unable to market seed and meal because contamination levels were unknown. Scientists at the SRRC developed reliable analytical methods for aflatoxin detection and provided standard samples of aflatoxins. These became the official methods of analysis and have been used by oilseed processors to ensure a supply of toxin free products for feed.

1966 – NOVEL COTTONSEED PRODUCTS PRODUCE HIGH ECONOMIC RETURN. By 1966, and estimated $533,000 in oilseed processing research in New Orleans had resulted in a cumulative net value added products of more than $41.4 million. New products made from cottonseed oil emerged from basic research on fats and oils, creating new markets for surplus oilseed crops. SRRC research has led to new or improved methods in every phase of cottonseed processing and contributed materially to the overall operating efficiency of oil mills and to new and improved cottonseed products.

1966 – PARTIALLY DEFATTED PEANUTS. Peanuts are a highly nutritious food but have a high oil content increasing their calorie count. Scientists at the Southern Regional Research Center developed a process for removing part of the oil from the peanut and then returning the lower calorie peanut to its original shape. Partially defatted peanuts are sold by several companies, including Weight Watchers.

1967 - RINGLESS SPINNING MACHINE is another useful invention by the Southern Lab for the mechanical processing of cotton spun yarns. Radically new, the ringless spinning machine eliminated the time and labor required to change bobbins and rewind yarn. It accomplished this feat by eliminating the bobbin.

1967 – COTTON STRETCH FABRICS. Stretch cottons were developed first in response to wartime military demand for elastic bandages. Later, to respond to the increased consumer demand for stretch cotton in diapers, socks and underwear, SRRC chemists developed processes based on slack mercerization to produce stretch cotton fabrics. Garments made from these fabrics are more comfortable and the method was quickly adopted by industry.

1967 – HIGH PROTEIN RICE FLOUR. In an effort to find new products from rice, scientists conducted fundamental research for better rice products. As a result, it was discovered that the outer section of the rice kernel contained the greatest amount of protein. An overmilling procedure was used to remove this protein rich outer surface in the form of a flour, leaving the residual kernels suitable for conventional uses. The high protein rice flour is incorporated into food products to improve their nutritive value.

1969 – USEFUL PRODUCTS FROM SOUTHERN PINES. Pine trees are a valuable resource in the southeast U.S. Scientists from the Naval Stores Laboratory, Olustee, FL,

associated with the SRRC developed many useful products from pine over the years. A more direct and less costly process for making paper sizing from pine gum was discovered. A variety of uses were also found for rosin acids in soaps, paints, varnishes, lacquers, and printing inks. Two compounds derived from turpentine were even used in the manufacture of essential oils for perfumes, and another acid found application in the photographic industry.

1969 – EDIBLE COTTONSEED FLOUR BY AIR-CLASSIFICATION OF GLANDED SEED. Cottonseed is an important oilseed and is used primarily to produce edible animal feeds. Even though cottonseed proteins have high nutritional value, they are rarely used in human foods. The presence of pigment glands that contain toxic gossypol have been the major obstacle in the exploitation of this valuable source of nutritious proteins. Scientists at the Southern Lab developed an economical air classification process for producing new edible cottonseed flour for human nutrition. The process yields an inexpensive protein concentrate that can be used in food formulation. Parts of this process are being used worldwide.

1969 – FLAME RESISTANT COTTON BATTING. Chemically treated cotton batting called Cotton Flote was developed by SRRC chemists, that was much improved over the old-style batting, which became shapeless and lumpy after prolonged use. Cotton Flote is so resilient and holds its shape so well that it has made cotton batting competitive with all types of cushioning and upholstery materials. Shortly after its patenting, scientists improved it by developing a technique for applying the flame retardant compound boric acid and its derivatives to cotton batting, thus rendering it resistant to burning. This permitted the safe use of cotton batting in automobile seats, furniture, and mattresses.

1969 – FLAME RETARDANT COTTON FABRICS. Early SRRC work centered on tetrakis(hydroxymethyl)phosphonium chloride (THPC) had the disadvantage of significant loss in fabric strength. Improvements to the THPC-based process were the fruits of many successful research efforts at the SRRC, culminating in an economical durable flame retardant finish for cotton. These were used by U.S. astronauts, in children's nightwear, firefighter and military uniforms and many other products. The specialized flame retardant fabrics developed by SRRC chemists resulted in the saving of lives and property.

1969 – IMPROVED HEAT, MILDEW AND ROT RESISTANT COTTONS. Many different chemical treatments were devised in New Orleans during the fifties and sixties to decrease cotton's vulnerability to attack from weathering, mildew and rot. The discoveries to develop heat, mildew and rot resistant cottons were used to improve cotton tents, tarpaulins, and boat covers. SRRC scientists also used partial acetylation to make cotton resistant to heat, a development responsible for the sale of millions of ironing board covers.

SOUTHERN REGIONAL RESEARCH CENTER
A DECADE OF RESEARCH IMPACTS – 1970s

1970 – EMULSIFIERS, STABILIZERS AND TEXTURIZERS FROM SUGAR AND COTTONSEED OIL. The development of sucrose esters was another chemical process of double importance because they were made in part from derivatives of two surplus crops: sucrose or table sugar, from sugar cane or beets, and fatty acids from cottonseed oil. The compounds are used today as emulsifiers, stabilizers, and texturizers in baked goods, baking mixes, frozen dairy desserts, and whipped milk products. They are also components of coatings for apples, bananas, and pears to retard spoilage, and a highly publicized fat substitute.

1970 – SCULPTURED COTTON LACE. Scientists at the SRRC developed a process based on a chemical procedure known as slack mercerization to construct novel cotton fabrics such as lace. The refined process gave lace a three-dimensional "sculptured" appearance. Lace has a flat appearance when prepared, while SRRC's chemical treatment enhances texture and design of lace, making it more attractive to consumers.

1970 – OIL REPELLANT FABRICS. World War II provided several challenges to scientists at SRRC. A process was developed for the Army Chemical Warfare Service which prevented liquid nerve gases from wetting and penetrating sateen fabric. Fabrics treated by this process were adopted by the U.S. Air Force for rocket handlers' clothing worn when liquid missile fuel were in use. This process led to oil-repellent fabrics and was patented in 1970, after being declassified by the Army.

1971 - DETOXIFICATION OF PEANUT AND COTTTONSEED MEALS. Peanut and cottonseed meals may contain small amounts of a toxic compound produced by fungi known as aflatoxin. Farm animals are adversely affected when fed animal feeds containing sufficiently high levels of aflatoxins. The inability to use contaminated meals results in a loss of valuable protein supplements for animals; moreover, the removal of these meals from the feed market represents considerable economic loss to growers and processors. In response, SRRC scientists developed a practical and economical procedure to detoxify contaminated oilseed meals. Aflatoxins in peanut and cottonseed meal can be inactivated by treatments with gaseous ammonia. This process enhanced the market value of these products.

1974 – SPIRAL CARDING, A NEW COTTON PROCESSING SYSTEM. Patented by SRRC engineers, the process cuts steps in separating individual fibers to allow them to be drawn into a strand and twisted into yarn.

1975 - SUPERIOR SYNTHETIC RUBBER. The synthetic rubber developed during WWII was of very poor quality. After the war, the synthetic rubber industry began a program to produce better synthetic rubber for use in tires. An essential chemical used in the process initiates the reaction at low temperatures. Scientists at the Naval Stores Laboratory, FL of

the Southern Regional Research Center improved the process for making synthetic rubber by substituting a chemical from citrus peel and pine trees for the initiator. The process was adopted by industry and is used to make over 1 million tons of synthetic rubber annually.

1975 – ANTIBACTERIAL COTTON FABRICS. Since textile fabrics have porous surfaces, they offer a medium for disease causing and odor producing bacteria. A new, durable antibacterial finish for cotton fabrics was developed that consisted of reaction products of zinc acetate, hydrogen peroxide, and acetic acid. The finish was called Permox for simplicity and later patented in 1978.

1977 – NOVEL METHOD FOR TRANSFER PRINTING OF COTTON FABRICS. Major advantages of heat transfer printing with disperse dyes are less water consumption, fewer seconds and better inventory control, eliminating the disadvantage of having to absorb the costs of large quantities of printed fabric that might not be used in the marketplace. Yet the process was mainly for printing polyester fabrics because of the affinity of polyester for disperse dyes. Although cotton has no affinity for disperse dyes, SRRC scientists developed a method to increase its dye affinity by chemical modification. It was the first process used commercially to produce durable, high quality prints on cotton fabrics. Today, zany designs that transfer onto cotton tee-shirts are very popular.

1978 – YARN PROCESSING SYSTEM. SRRC engineers designed, built, and operated a prototype system to process raw cotton stock continuously into yarn.

SOUTHERN REGIONAL RESEARCH CENTER
A DECADE OF RESEARCH IMPACTS – 1980s

1980 – NO TWIST YARN SYSTEM. A method to produce no-twist cotton yarn directly from card web was developed by SRRC engineers. The technique is made possible by a unique device for aligning the fibers in the web to form a no-twist yarn in a one-step operation. Since spinning is the most costly operation in conventional yarn manufacturing, with the need to insert twist limiting the speed yarn can be produced, producing yarns without twist allows for higher production rates and fabrics with unique qualities that offer advantages for many applications.

1984 – BY-PRODUCTS FROM CATFISH PROCESSING WASTE. Adequate methods to dispose of catfish processing waste (ofal) are needed in order for the farm-raised catfish industry to continue its rapid expansion. The inedible parts removed during processing comprise 40% of whole fresh fish weight. Such wastes can be converted into valuable by-products to economically benefit the industry. To address this need, SRRC scientists developed a method and the equipment to process channel catfish offal into a liquid catfish protein suitable for use in animal feedstuff and a natural plant fertilizer. The process is simple and can be used by small and large operators.

1984 – ELIMINATION OF ENDOTOXIN IN COTTON DUST. A novel apparatus to extract fine trash and hazardous cotton dust in the air during textile processing operations was patented by SRRC engineers. This was a major advance in dealing with byssinosis, a lung disease found in some cotton textile workers. Research on the causative agents of byssinosis was also high priority research since 1975. It was discovered that endotoxins, characteristic components of the cell wall of gram-negative bacteria found in cotton fibers as well as in the atmosphere of textile mills, were the cause of byssinosis. SRRC chemists patented a method for the elimination of endotoxin in cotton dust without detrimental effects in the processing of the fiber into yarns and fabric.

1987 – METHODS TO DETECT OFF-FLAVORS IN CATFISH. Off-flavors develop in farm raised catfish and pose the single most serious threat to the fastest growing branch of aquaculture, the catfish industry with annual estimated revenue of $470 million. These off-flavors result in economic losses of up to 20% of the farm value. Catfish farmers turned to SRRC for help. In response, scientists researched ways to detect and prevent the problem. Scientists discovered that off-flavors, described as earthy/musty flavors, are caused by Actinomycetes and blue-green algae producing compounds called geosmin and MIB (methylisoborneol). Researchers found these microbes cause significant problems for both domestic water supplies and fisheries. Simple methods of analysis for geosmin content in fish, and of the water in which fish are raised, are therefore needed. Researchers developed sensitive methods for detecting these off-flavors and test kits for monitoring levels of the two chemicals in drinking water and fish. The work has sparked the interest of water utility officials worldwide.

1987 – POLYTHERM, TEMPERATURE ADAPTIVE TEXTILES. Polytherm is another fabric treatment developed by SRRC chemists where polyethylene glycols are permanently attached to cotton. The resulting fabric absorbs and releases heat over temperature ranges governed by the size of the polyethylene glycol. Temperature adaptive textiles with built-in thermostats warm you when it is cold and cool you when it is

hot. The process won Popular Sciences' Grand Award for Materials in 1988. The patent is being marketed by NeutraTherm for thermal underwear and socks. The U.S. Ski team uses clothes made of polytherm. A Japanese company has licensed to market solely in Japan and estimated sales are over one million yards of polytherm treated fabric per year.

1988 – FLAN-LIKE PUDDING FROM SURPLUS AGRICULTURAL COMMODITIES. Continuous changes in lifestyle have increased our life expectancy, increased our awareness of health and fitness, and created a need for novel, nutritious and wholesome foods. Scientists at the Southern Regional Research Center have developed a flan-like food from surplus agricultural commodities such as nonfat dry milk, rice, and peanuts. All ingredients are natural, available in dry form and can be blended. The product is prepared by adding water, stirring and heating. The cooked slurry is placed in a mold to give an egg custard like flan. Minerals or vitamins may be conveniently added. The final product is naturally rich in much needed calcium and is uniquely suited for the elderly as snack, dessert, and even as a complete meal.

1989 – INHIBITION OF WARMED-OVER FLAVOR IN MEAT. SRRC scientists found a way to control flavor loss from oxidation in meat, thus preserving desirable meat flavor quality. A derivative from chitin, the fibrous portions of shells from crab, shrimp, lobster, and crayfish, is used to inhibit iron in meat from reacting with oxygen and causing the off-flavor. A volunteer, trained taste panel tested samples of treated meat and results showed no warmed over flavor. The technology was patented and when commercialized can be applied to meats at the slaughterhouse or during food processing.

SOUTHERN REGIONAL RESEARCH CENTER
A DECADE OF RESEARCH IMPACTS – 1990s

1990 – FORMALDEHYDE-FREE DURABLE PRESS COTTON FINISHES.
The demand for durable-press finishing agents that neither contain nor release formaldehyde when applied to cotton fabrics resulted from international recognition that formaldehyde is a human carcinogen. Elimination of noxious formaldehyde was the goal, especially with the exposure to formaldehyde in the workplace being strictly regulated by OSHA. SRRC chemists pioneered crosslinking of cotton with epoxide agents; silicone treatments for smooth drying cottons were then developed. And a widely used non-formaldehyde agent for durable press is the reaction product of DHDMI, patented in 1963. Later chemists refined the finish to butanetetracarboxylic acid (BTCA) with citric acid, producing fabrics with a high level of appearance properties at low cost and proven lack of toxicity.

1990 - DYEABLE DURABLE PRESS COTTON. Important research that contributed significantly to the development of the science of the dyeing of cotton was conducted by SRRC chemists. SRRC chemists developed a variety of techniques that allowed cotton to be dyed after it was treated with a no-wrinkle finish. The techniques opened the door to a broader range of patterns and more vibrant shades for consumers, while saving industry money – without reducing the breathability, absorbency, and comfort of cotton. The textile and garment industry demanded cotton fabric be dyed before a no-wrinkle finish was applied to keep up with the ever-changing fashion world. Chemists at the SRRC developed techniques that allow industry to apply a no-wrinkle finish to cotton fabric before dyeing. A variety of quaternary ammonia salts were added to the no-wrinkle finish; by adding a positive charge to the fabric, the modified finish attracts dyes, allowing no-wrinkle cotton to be dyed. The new techniques increased cotton's marketability and numerous patents were issued. The modified finishes and techniques also broadened the choice of dyes, giving industry a wider range of vibrant colors. The processes contribute to the technological basis for the garment dyeing industry.

1990 – CORE-SPUN YARNS. Consumers prefer cotton because of its comfort, durability and absorbency. Yet untreated cotton fabric shrinks and wrinkles, unlike synthetic fabrics, such as polyester. All cotton fabrics must be chemically treated to impart desirable properties like durable press, shrink resistance or flame resistance. However, chemical finishes generally result in loss of durability. This led to blends of cotton and synthetic fibers and became a middle-of-the-road fabric that pleased consumers. Yet these conventional blends had deficiencies: they pill, making small unsightly balls on fabric, do not have the desired comfort of 100% cotton, and are difficult to be made flame retardant. Research at SRRC led to the development of a new spinning technology for producing a unique "core-wrap yarn." The yarn is composed of a central core of a strong 100% synthetic fiber and a sheath (wrap) of 100% cotton fiber uniquely interlocked to prevent stripping of the cotton sheath. It is very similar to an electrical wire where metal wire is

entrapped by a rubber coating. The core of the yarn provides the excellent mechanical properties while the sheath provides the traditional comfort properties of cotton. Fabrics made with these new core yarns exhibit levels of permanent press, wrinkle recovery, shrink resistance, tear strength, durability and the desirable characteristics of cotton. The invention is patented and exclusively licensed by Firesafe Products (True Core-Wrap Yarns™).

1991 – PESTA FOR ENCAPSULATION OF BIOLOGICAL CONTROL AGENTS. Prevention of crop disease and weed control is essential to effective agriculture. Fungal weed pathogens and pest control nematodes are difficult to formulate into effective biocontrol products because, as living organisms, their viability must be preserved throughout processing and storage. Scientists at the Southern Regional Research Center have devised a method for the encaspsulation of living biological control agents into granules. They discovered that when semolina is mixed with either nematodes or fungi, the result is effective biological control of insects and weeds. Biodegradable alginate granules containing the beneficial organisms are produced by a simple and inexpensive process that does not expose people to dangerous materials. These new formulations enhance the control of a wide variety of agricultural pests in an ecologically sound, non-polluting manner.

1991 – PRODUCING TAXOL IN TISSUE CULTURE. A drug made from the bark of the Pacific yew tree called Taxol has been successful in treating cancer in clinical trials. Harvesting the bark means sacrificing the trees, which are in short supply and take nearly 50 years to grow to harvest. Taxol is also too complex to artificially synthesize. SRRC biologists used tissue culture techniques to grow just the taxol producing cells of the yew tree in the laboratory. The process was patented and licensed to Phyton Catalytic Inc. to commercialize this human and tree saving process.

1992 – NOVEL CARBONATED MILK BEVERAGE. The continuous changes in lifestyles are creating the need for more convenient foods. Traditional family meals are being replaced by fast foods or snacks. These foods are consumed with soft drinks rather than milk. Dietary changes have important nutritional implications as milk is one of the major sources of calcium in American diets. In an effort to find use for surplus non-fat dried milk and cater to a population that drinks sodas instead of milk, food scientists at the SRRC developed novel carbonated milk and fruit juice beverages to provide a convenient and healthy choice.

1993 – STABLE BROWN RICE. Brown rice is a nutritionally valuable food with bran layers rich in fiber, minerals, oil, protein and vitamins. Utilization of brown rice and its bran has been limited due to the oil's susceptibility to hydrolytic and oxidative deterioration. This deterioration leads to off-odors, off-flavors, and shortened shelf life. To solve this problem, SRRC scientists patented a process using ethanol vapors to stabilize brown rice to lipolytic hydrolysis. The process provides full-fat or partially defatted stable brown rice kernels with little or no loss of nutrients and cooking properties of brown rice.

1994 – MEASUREMENT OF FOOD FLAVOR AND AROMA. The acceptance of food in the marketplace is dependent upon its flavor quality. Scientists at the Southern Regional Research Center have developed unique sensory methods for monitoring and measuring flavor related volatiles or contaminants in food. This technology assists the food industry in maintaining high quality standards in processed foods.

1997 – CRISPY, LOW FAT FRIES FROM RICE BATTER. Potato-based french fries are a popular fast food all over the world, but are high in fat content. Potatoes and rice have similar compositions and the rice industry envisioned developing french fry-like food using rice products. SRRC scientists therefore, developed rice fries using white rice flour and water; the mixture is extruded and molded into conventional french fry shape, like commercial breakfast cereals. When fried, the snack is crispy on the outside and fluffy white on the inside. When analyzed, the rice fries had 50% less fat than potato fries.

1998 – SUGARCANE JUICE CLARIFICATION METHODS. Working with the Louisiana sugarcane industry, SRRC scientists demonstrated the best methods to clarify sugarcane juice. After harvest, the juice is extracted and it is clarified to remove impurities. The traditional clarification process is called cold liming, where cane juice is mixed in a tank with lime at about 105 °F. Researchers discovered that switching from cold to hot or intermediate tempeature liming, a factory reduces its sugar losses and its lime consumption along with reducing the needed chemicals to clean its heat exchangers by 90%. The process translates to over $4 million savings per year for most of the Louisiana factories.

1999 – ACTIVATED NUTSHELL CARBONS. About 50 million tons of agricultural wastes in the form of nut shells mainly from pecan, almond and macadamia nuts are generated each year. SRRC scientists created new uses and value-added products from these wastes. Using an array of techniques, charcoal-like substances called activated carbons were made. Grinding and exposure to temperatures of up to 900°C activates by opening millions of microscopic pores in the carbonized shells, enabling them to hold onto molecules like benzene, toluene, acetonitrile, as well as heavy metals like lead. “We’re using waste to clean up other wastes.” The activation process is patented and scientists estimate a yield of 3,000 tons of activated carbon material from available macadamia shells alone. Carbons from nutshells create a ‘greener’ technology than making them from coal and they are ideal for industrial cleanup as well as purifying tap water.

SOUTHERN REGIONAL RESEARCH CENTER
A DECADE OF RESEARCH IMPACTS – 2000s

2000 – CONTROL OF THE CARCINOGEN, AFLATOXIN USING BIOTECHNOLOGY. $139 M is the estimated annual revenue lost by U.S. farmers from preharvest contamination of crops, such as peanuts, corn, cotton, and treenuts. In chronic areas, toxin contamination can be so severe that more than half of the corn and peanut crop is lost. U.S. export losses total $120 M annually under EU regulatory standards for aflatoxin levels in peanuts alone. Moreover, total mycotoxin (all fungi toxins) related losses to agriculture are as high as $1.4 billion annually. To address this costly problem, SRRC scientists are conducting research using biocontrol, host-plant resistance, and bioengineered crops to reduce aflatoxin contamination. One successful biocontrol strategy developed and applied to Arizona cottonseed uses natural non-toxin strains of the fungus *Aspergillus flavus* for field control of aflatoxin, produced by toxic cousins of the same fungus. The biocontrol strategy has resulted in 80% reduction in cottonseed contamination, translating to over $5.5 M economic benefit annually. In addition, the use of this technology in corn provides $5 M in economic relief to farmers annually.

2001 – MICROBES FOR BIOREMEDIATION. SRRC scientists patented a formulation of fungal microorganisms that have the capacity to decompose chemical pollutants and serve for the bioremediation of contaminated sites.

2001 – RICE BATTER FOR HEALTHIER FRIED FOOD. Fried chicken is finger-lickin' good because of the oil and batter it's cooked in; but the tastey combination adds fat to our diets. SRRC scientists provided a solution in a new rice flour batter that absorbs 60% less oil than standard commercial batters made from wheat. The rice batter maintains a crispy texture and offers the advantage of being gluten free. The patented invention is licensed by CrispTek LLC and the rice based product is marketed as ChoiceBatter. By 2010, ChoiceBatter was sold in over 400 stores, including 4 major grocery store chains, and year 5 sales are in excess of $5 million.

2002 – INFANT FORMULA CONATINING ESSENTIAL FATTY ACIDS. Mead Johnson Nutritionals, a subsidiary of Bristol-Myers Squibb, introduced Enfamil Lipil, the first baby formula to contain DHA and ARA, two essential fatty acids also found in human breast milk. This nutritional advance was helped along by researchers at SRRC. The infant formula market is $8 billion a year and DHA is incorporated in almost all infant formulas.

2003 – SMART COTTON WOUND DRESSING. About 1 million Americans develop chronic wounds resulting in patient care costs of over $750 million annually. As cotton fibers are excellent carriers for wound healing agents, SRRC scientists invented a new kind of cotton dressing. In normal wounds, proteases break down dying tissue and clear debris; in chronic wounds, these enzymes build up and impede healing. The new wound dressing applies inhibitors of protease to the wound site to enhance healing. Tissue

Technologies has licensed the patent. Clinical trials were approved by FDA and the dressings are currently being used in negative pressure chronic wound therapy.

2003 – VARIETAL IMPROVEMENTS OF LOUISIANA SUGARCANE. Sugarcane was introduced to southern Louisiana by the Jesuits in 1751. But in the early 20th century, root rot and mosaic virus nearly destroyed the crop and the industry. The USDA established a research station in Houma, Louisiana and over the years helped save the sugarcane industry through introductions of disease-resistant and disease-tolerant varieties. Varietal improvement work continues to this day.

2004 – STANDARDIZATION OF INTERNATIONAL COTTON QUALITY MEASUREMENTS. An SRRC scientist served as a scientific emissary to ensure the transfer of a quality measurement system developed by USDA and China. The Chinese system requires use of the U.S. cotton measurement system, making U.S. cotton more favorable than cotton from other countries. According to U.S. cotton growers, without the new U.S. system, all cotton exports to China would have been eliminated.

2004 – NATIONAL HISTORIC CHEMICAL LANDMARK. Southern Regional Research Center is designated as a National Historic Chemical Landmark by the American Chemical Society for “The Evolution of Durable Press and Flame Retardant Cotton”. The distinction is offered to less than 40 scientific achievements in the country.

2004 – UNRAVELING THE GENETICS OF COTTON FIBER DEVELOPMENT. Cotton represents nearly half of the world's natural fiber consumption. Cotton fibers are single cells elongating from a cottonseed. SRRC scientists teamed up with other researchers from University of Texas and Texas A&M University received a $2.2 million grant from the National Science Foundation (NSF) to dissect early events in cotton fiber development. The grant stimulated the genetic and functional research of cotton fibers by developing expressed sequence tags (ESTs), molecular markers and microarray gene chips.

2005 - SUNBUTTER™ FROM SUNFLOWER SEED. With the decrease in U.S. sunflower seed market by the late 1990s, new value-added products were needed to expand its market. In response, a sunflower butter was formulated by SRRC scientists that closely resembled the texture, flavor, spreadability, and nutty appearance of commercially available peanut butter. Development of this technology expanded the U.S. sunflower market through increased production, profits for farmers, creation of a company with the largest facilities for sunflower roasting as well as creating new jobs, along with providing an alternative to those with peanut allergies. Sunbutter™ is classified as an official commodity of the USDA school lunch programs and is available in many grocery food chains, has been adopted by several schools as a substitute for peanut butter and is being used as an ingredient in many foods. Overall sales from this technology are estimated at over $25 million per year.

2005 – SIGNIFICANT SAVINGS IN SUGAR LOSSES DURING SUGARCANE PROCESSING. SRRC scientists showed that lowering the acidity in the final syrup can

save a factory at least $214,000 per year in sucrose losses. Louisiana factories adopted these findings and reduced their sucrose losses at cost savings of over $2.3M annually.

2007 – GENOME SEQUENCE OF *ASPERGILLUS FLAVUS*. *Aspergillus flavus,* a fungus that produces aflatoxins, is the most potent naturally occurring liver carcinogen. In addition to damaged human health, the economic losses due to aflatoxin contamination are estimated to be more than $1 billion in the U.S. SRRC scientists, in collaboration with J. Craig Venter Institute, North Carolina State University and Rutgers University, have for the first time completed the genome sequence of the fungus. The genome sequence has resulted in genome-based efforts to understand the regulation of aflatoxin biosynthesis in order to discover new control strategies for the management of aflatoxin contamination.

2007 – RICE BREAD FOR ALLERGENIC PATIENTS. Rice is an important food grain, having the unique attributes of ease of digestion and hypo-allergenic properties. Rice proteins, however, are devoid of the elastic properties of wheat, essential for making bread. Yet, SRRC scientists discovered that adding small amounts of defatted bran improved the texture and flavor of rice bread. The final baked bread was comparable to whole wheat bread. It is an ideal food for patients suffering from celiac disease and gluten allergies.

2007 – PHYTASE IN ANIMAL FEED FOR BIOAVAILABILITY OF NUTRIENTS. Phytase enzymes have great potential for improving mineral nutrition and protecting the environment from phosphorus pollution from animal waste. Adding phytase allows monogastric animals, poultry and swine, to utilize the phytate phosphorus in this plant meal. Without phytase, the phytate bound phosphorus is unavailable to these animals and is excreted in their manure where it pollutes the environment by further elevating phosphorus levels. The increased use of plant proteins such as soybean meal in animal feed has created an expanding market for phytase as an animal feed additive. SRRC scientists isolated a specific nucleic acid to encode a mutant phytase. The phytases are added to animal feed and increase the bioavailabilty of phosphate resulting in quicker weight gain in poultry and pigs while reducing pollutants from phosphorus. The technology has been patented and is widely used in animal feed.

2008 – DETECTION AND DIFFERENTIATION OF TOXIGENIC FUNGI USING HYPERSPECTRAL IMAGERY. It is important to detect and identify the different toxin producing fungi encountered in food production as they pose a threat to human and animal health. Thus, SRRC scientists and collaborators developed a simple, non-invasive method to rapidly identify fungi by means of hyperspectral images. The identification of a fungus is helpful in detecting the specific toxin produced by the identified organism. The fungal detection/identification technology is useful in food inspection, homeland security, household inspection, mold remediation, and environmental protection.

2008 – APPLICATION OF DEXTRANASE ENZYME TO CONTROL DEXTRAN IN THE SUGAR INDUSTRY. Dextranase application in U.S. and worldwide sugarcane and sugar

beet factories was not optimized. By conducting large laboratory and factory studies, multiple technologies were transferred to U.S. and factories in U.K, Spain, The Philippines, India, Brazil, etc. that optimized dextranase applications. The domestic value of this technology transfer has been estimated to be at least $1.4 millon per year.

2009 – BIOCAHRS AND ACTIVATED CARBONS FROM POULTRY MANURE. Manure represents a significantly large and problematic portion of agricultural waste generated yearly, with poultry manure estimated at 9 million tons. Consequently there is an urgent need for new uses and value-added products from poultry manure. SRRC scientists invented biochars and activated carbons from poultry manure that possess enhanced adsorption ability for metal ions. Coupled with the need to remove toxic metals from water to ensure safe water for consumption and recreation, this invention helps solve two problems by taking care of poultry waste and toxic metal contaminants.

2009 – ENZYMATIC BIO-PROCESSING OF COTTON: NEW ROAD TO "GREEN CHEMISTRY". Scientists at SRRC have found that ultrasound boosts enzymatic activity during various cotton textile processing applications. Mild conditions of temperature and pH are required and harsh chemicals are replaced. The bio-process generates significantly less hazardous, biodegradable wastewater effluents and therefore poses no environmental threat. Enzymatic treatments of cotton fabrics supplemented with ultrasonic energy results in shorter processing times, less consumption of expensive enzymes, less fiber damage and better uniformity of treatment to the fabric.

2009 – IMPROVED COTTON COLOR MEASUREMENT SAMPLING SYSTEM FOR LARGE SAMPLES. Cotton fiber color is an important quality property and one of the official cotton classification parameters. Color measurements on standard bench-top color spectrometers present challenges for large-size samples, such as those used for international color fiber standards. To address this issue, SRRC scientists developed a new, versatile cotton fiber sampling system for the color measurement of large samples of cotton for spectrophotometer cotton color measurements. Multiple systems were fabricated and installed at the USDA Agricultural Marketing Service (AMS) and Cotton Incorporated.

SOUTHERN REGIONAL RESEARCH CENTER
A DECADE OF RESEARCH IMPACTS – 2010s

2010 – REDUCING POPULATIONS OF FORMOSAN SUBTERRANEAN TERMITES. The Formosan subterranean termite (FST) is one of the most destructive pests with estimated yearly losses reaching $4 million in the New Orleans, Louisiana area and more than $2 billion across the U.S. Its density in the New Orleans French Quarter is very high and has been noted as the ultimate demise of the French Quarter. A pilot project to treat all French Quarter properties using Area Wide Management began in 1998 as a cooperative effort between LSU Agricultural Center, SRRC, Audubon Nature Institute, and New Orleans Mosquito and Termite Control Board. By the time the project ended in 2012, results from in-ground monitory stations showed a 95% decline in termites. A conservative estimate of 50% reduction equates to approximately $150 million saving annually in New Orleans alone. Numerous patents were issued forming the basis for less toxic, environmentally friendly compounds to control FST along with a patent for a termite bait matrix for early detection used by pest control companies.

2010 – A BETTER MEASURE OF SUGAR CROP DETERIORATION. For over 100 years the U.S. and worldwide sugar industry have used dextran as a measure of microbial deterioration, but all current industrial methods have associated problems. Mannitol was shown to be a better measure of microbial deterioration and an enzymatic method was developed by SRRC scientists to easily, rapidly, and inexpensively measure it at the industrial site. The method is being used in European, U.S. and other country sugar beet factories, and in sugarcane breeding programs worldwide.

2010 – IMPROVING THE QUALITY OF FRESH CUT FRUIT. Fresh-cut fruit products have increased in the market place and the fresh-cut fruit industry is expected to have unprecedented growth. However, processors face numerous challenges requiring new and higher levels of technical and operational sophistication. Scientists at SRRC developed processing treatments to help the industry by improving quality and shelf-life of cut fruit.

2011 – BIOPESTICIDES EXTENDED TO AFRICA HELP REDUCE HUMAN EXPOSURE TO AFLATOXINS. In collaboration with the International Institute of Tropical Agriculture and with the support of the Bill & Melinda Gates Foundation, SRRC scientists have developed natural biopesticides for African nations to help reduce human exposure to aftatoxins and the profitability of U.S. agriculture.

2012 - HIGH DENSITY CONSENSUS COTTON GENETIC MAP FOR LOCATING IMPORTANT GENES CONTROLLING AGRONOMIC TRAITS. In collaboration with scientists from France and Clemson University, SRRC scientists constructed the first high density consensus cotton genetic map that contains 8500 marker loci. This map has been used to identify genes regulating agronomic traits, and to assemble the genome sequence of upland cotton.

2013 – IMPROVED COTTON QUALITY ASSESSMENT METHODS. New and improved quality assessments of cotton fibers and yarns were developed by SRRC scientists. To address critical issues and challenges of quality and processing faced by the cotton and textile industries, cutting edge physical, chemical, spectroscopic, imaging, and modeling techniques were used. The most notable developments were: 1) portable technique for micronaire measurement by a Near Infrared (NIR) analyzer. It is the first application of NIR spectroscopy for field testing of cotton plants; 2) a chemical measurement of the actual water content in fibers, ASTM D7785; 3) a fast Fourier transform infrared spectroscopy method to measure fiber crystal properties, replacing the time-consuming X-ray diffraction method; 4) Cottonscope introduced and implemented by the manufacturer as the official cotton standards; 5) a new chromatography method to quantify plant and pest sugars on fiber, in use by several stakeholders; and 6) Lower Half Mean Length, as cotton short fiber content and length distribution measurement.

2014 – NONWOVEN COTTON FABRICS FOR DISPOSABLE DIAPERS. The use of cotton fibers in nonwoven absorbent products is desirable because cotton is naturally renewable and biodegradable and is soft, absorbent, and has hypoallergenic properties. Innovations made by SRRC scientists in cotton cleaning and nonwovens hydroentanglement processes have made it possible to use greige (non-bleached) cotton in nonwoven absorbent products. The technologies open and expose the hydrophilic cellulosic component of greige cotton fiber to water absorption making them ideal for absorbent products. The nonwovens are used in a biodegradable sustainable diaper called Touch of Cloth™ by the Seventh Generation™ Corporation available in Target™, Walmart™ and other global retailers. The nonwovens technology may be used in other products such as adult incontinence, feminine hygiene and wound treatment. Moreover, the use of cotton in nonwovens creates a new market for cotton as it displaces the use of synthetic fibers. A modest 20% penetration of the market equates to an estimated $500 M to the cotton industry.

2014 - ENVIRONMENTALLY FRIENDLY FLAME RETARDANTS FOR COTTON. Halogenated flame retardants are widely used chemical treatments for cotton; yet the textile industry wants to move away from the compounds and find benign alternatives that also avoid imparting stiffness to fabric. To meet this need, SRRC scientists created phosphorous-nitrogen-containing chemicals that when applied to cotton demonstrated a low cost, easily manufactured flame retardant finish for cotton fabrics. The environmentally friendly treatments can be used in clothing for firefighters and pediatric sleepwear.

2014 – CHARACTERIZATION OF PEANUT AND TREE ALLEGERGENS. Peanut and tree nut allergies are very severe and rarely outgrown. To study peanut and tree nut allergens, access to both native and recombinant purified protein allergens are needed in order to assess the effects of processing and mutagenesis on the structure and immunological properties of the individual allergenic proteins. SRRC scientists are developing new methodologies for expression and purification of recombinant and native allergens. These purified allergens from peanut and tree nuts have allowed many high-

impact research projects including assessing the effects of processing peanut and tree nut on allergenic properties, reduction of allergenic properties, determination of crystal structures and models, development of detection methods for peanut and tree nut allergens, and gaining insights into cross-reactivity among nuts.

2014 – FIRST METHOD TO MEASURE BOTH INSOLUBLE AND SOLUBLE STARCH. Industrial methods to measure starch in sugar industry products all measured mostly soluble starch. SRRC scientists, via large-scale factory studies, showed that considerable amounts of insoluble starch persist across sugarcane factories and even refineries, with negative implications for processing. A novel method based on microwave-assisted sonication was developed to measure both insoluble and soluble starch, which has opened up numerous avenues of new research and problem solving in the U.S. and world-wide sugar industry.

2014 – MINIATURE SCALE PROCESSING FOR COTTON. New cotton varieties and ginning techniques should be assessed by textile processing prior to implementation, but full-scale textile processing requires significant quantities of fiber, energy, and is time consuming. Therefore, SRRC scientists established a miniature processing system for very small fiber samples (down to 30 grams). The system processes yarn from fiber to woven fabrics and allows researchers, breeders, and ginners to quickly make decisions based on yarn properties. Miniature scale processing has successfully replicated processing trends observed in large scale processing on comparative samples and over 1,500 breeder and research samples have been processed on the miniature system per year. This technology is being used by ARS and industry breeders, geneticists, gin labs, the domestic textile industry and national organizations.

2015 – CATFISH FLAVOR CHECKERS. Catfish processors check the flavor and other sensory properties of catfish before they are accepted for processing into catfish products. The people checking the catfish flavor are referred to a flavor checkers. SRRC scientists are working with the flavor checkers and held a catfish flavor checkers workshop where participants were presented samples to determine thresholds for perceiving the common catfish flavors. The workshop provided the starting point for the nomenclature of catfish flavor attributes methods detection.

2015 – BIOCONTROL OF AFLATOXIN CONTAMINATION. Started in 2000, more than 1 million acres of U.S. grown cotton, corn, peanuts, pistachios, and figs have been treated with EPA registered and patented biopesticides containing atoxigenic strains of *Aspergillus flavus* as active ingredients to control aflatoxin in these crops with significant reductions in aftlatoxin levels.

2015 – BREEDING GENETICALLY IMPROVED COTTON. New cotton genotypes with improved fiber properties are critical to cotton breeders and the cotton industry. To effectively
use DNA markers to assist breeding requires characterizing a cotton line by analyzing thousands of markers. It is very difficult and expensive to fingerprint a cotton line using a moderate number of markers, such as 500. SRRC scientists first developed more than 4000 SNP markers and working as a member of International Cotton SNP Chip Consortium, developed new cotton genotypes with improved fiber properties. The Cotton SNP Chip, containing markers associated with cotton fiber quality and yield was

developed. The SNP chip is a major new resource for the global cotton research community and is being used by cotton breeders to characterize cotton lines and assist with breeding. The Cotton SNP Chip has been manufactured by Illunina, Inc.

2015 – SOY-BASED PRODUCTS FOR TREATING OBESITY AND DIABETES. Obesity is reaching epidemic proportions and is commonly attributed to the high fat consumption and sedentary lifestyles of Western populations. Diseases due to obesity result in billions of dollars in health care costs. Although nothing should replace a healthy diet with exercise, SRRC scientists in collaboration with Microbiome Therapeutics have developed a safe and effective medical food to help. Scientists discovered that unique soy compounds called glyceollins stimulate glucose uptake much like insulin. Glyceollin enriched foods ameliorate the symptoms of diabetes and assist in the management of insulin resistance. The methods are patented by SRRC and licensed by Microbiome Therapeutics.

2015 – SILVER NANOPARTICLES FOR ANIMICROBIAL COTTONS. A novel method to synthesize silver nanoparticles using the unique structure of cotton fiber was developed by SRRC scientists. The novel and green methodology expands the utilization of cotton to high-technology areas that require antimicrobial activity.

2015 – COMMERCIALIZATION OF SWEET SORGHUM JUICE CLARIFICATION FOR LARGE-SCALE SYRUP MANUFACTURE. The precipitation and burning of insoluble starch granules from sweet sorghum juice on heating coils prevented the large-scale manufacture of syrup at Hekemeyer Mill, Sikeston, MO. A SRRC scientist showed that both starch concentration and granule size contributed to processing problems, and the application of juice de-aeration, settling, and a newly developed USDA juice clarification process (heat to 80 degrees centigrade; adjust the juice pH to 6.5 with milk of lime; 5 ppm flocculant; settling for 1 hour) enabled the large-scale manufacture of syrup. Quality and processing differences due to cultivar and environmental effects were also overcome and this assured continual supply of clarified syrups to customers. This research allowed Heckemeyer Mill to become the first fully operational large-scale sweet sorghum plant in the U.S.

2016 – RESVERATROL FROM SUGARCANE. Beneficial health effects with the consumption of fruits and vegetables are associated with reducing diseases including cardiovascular disease, cancer, atherosclerosis and other age related diseases. Resveratrol, a compound found in significant quantity in grapes and also in red wine plays an important role in healthy diets. A diet high in fats but also high in red wine consumption results in a lower incidence of cardiovascular disease, the so-called “French Paradox”. Similarly, SRRC scientists discovered and patented a method to produce resveratrol from sugarcane. Drinking sugarcane juice could, therefore, have similar health benefits as red wine.

2016 - COTTONSEED-BASED ADHESIVE FORMULATIONS FOR INDUSTRIAL APPLICATIONS. Because of environmental regulations regarding emission of organic compounds including formaldehyde, commercial wood adhesive products involving soy

protein are now available. Yet, these products require increased adhesive strength, improved water resistance and lower costs to produce. To address these issues, SRRC scientists have shown that cottonseed protein isolate and washed cottonseed meal exhibit superior adhesive strength and water resistance relative to soy protein isolate. On a pilot scale in collaboration with academic and industrial partners, cottonseed meal and protein-based blending adhesives were formulated by adding a second component such as starch, cellulose, hemicelluloses, organic acids, amino acids or denaturant agents. These additives provide adhesive performance and operation flexibility in industrial applications. They also provide an opportunity to introduce cottonseed protein in adhesive formulations and decrease the cost of use.