

## PRIVATE COTTON BREEDING IN THE SOUTHEAST

Henry W. Webb  
Retired, Coker Pedigreed Seed Company  
Hartsville, SC

### Abstract

Private cotton breeding in the southeast began in 1901 when Mr. D. R. Coker of Hartsville, South Carolina, made 30 individual plant selections, planting these in plant to row progenies in 1902. This coincides with the rediscovery of the Mendelian laws of inheritance and was the first breeding program based on these scientific principles.

Originally conceived as a public service to benefit the struggling farm population of the rural South, the Coker program progressed rapidly with new innovative varieties of the principle southern farm crops, and by 1918 was officially incorporated as Coker's Pedigreed Seed Company. Surviving the financial hardships of the depression, the company evolved as a moderately successful business and continued to produce and market a series of outstanding varieties, greatly enhancing the economy of the South, as well as other areas of the Cottonbelt. The Coker family sold the company to KWS, a German seed company in 1979, and it was subsequently resold to Northrup King Co. in 1988.

The Coker 312 variety, wide used in transgenic cotton research, could be one of Coker's most significant contributions to future cotton breeding.

### Introduction

A discussion of cotton breeding in the Southeast is inseparable from that of the Cokers of Hartsville, South Carolina. History indicates that 1776 was a formative year for U.S. cotton, which coincided with the Revolutionary War. Prior to this period, supplies were very limited and primarily for home consumption. Increasing demands both domestic and foreign, particularly England necessitated rapid and significant increases in production. The development of the Whitney gin about 1793 was also a major stimulus, greatly increasing the efficiency and economics of cotton to the manufacturer.

These early developments over 200 years ago coincide with the beginning of the Coker family's interest in scientific farming and cotton improvement. In 1878, Thomas Coker was granted a tract of 1,000 acres in Darlington County, South Carolina, by Governor Moultrie for services under General Francis Marion during the Revolutionary War. Thomas Coker was the forefather of over 5 generations of

some of the most outstanding and successful scientists the South has produced including such advanced specialists as chemists, engineers, physicists, physicians, agriculturists, pathologist, and plant breeders.

James Lide Coker, great-grandson of Thomas Coker, attended the Citadel of Charleston, South Carolina and Harvard University during the 1850's. At Harvard he studied with some of the most distinguished professors of that day with special emphasis on chemistry, botany, and zoology. With his interest in science and agriculture, he returned to Hartsville and began applying his training evaluating the efficiency of various sources of fertilizer on cotton yields.

Following the War Between the States, James Coker, a major crippled from war wounds, returned home and resume his field experimentation and application of science to farming. However, it was James' son, David R., who would become the motivating force behind the development and growth of Coker's breeding program during the 20<sup>th</sup> Century.

### The Next Generation of Cokers

The multidisciplinary training of Major James Coker and his sons, James Jr., David, William, and Charles led to the development of several major industries around the turn of the century. These include (1) Sonoco Products Company, under the engineering oriented management of James Jr. and Charles Coker. During its 100 year history, Sonoco ahs grown from a small company making paper cones for the textile industry into one of the world's largest packaging corporations. (2) Coker's Pedigreed Seed Company, grew out of David Coker's determination to improve the financial stability of cotton and other farm crops of the region. The history of David Coker and Coker's Pedigreed Seed Company have been detailed in a recent book by James Rogers of South Caroline simply entitled Mr. D. R. This biography of Mr. Coker, the recipient of three honorary doctorates, enumerates his many accomplishments including distinguished agriculturist, agricultural education, member of Federal Food Administration in World War I, member National Agricultural Advisory Committee, Member National Agricultural Commission of Europe, 1981, member of South Caroline Land Settlement Commission, philanthropist, naturalist, and peerless leader of men. (3). Other significant early interests of the Cokers included The Coker Cotton Company, Hartsville Oil Mill, The Bank of Hartsville, Coker College, Coker Wholesale, and a general merchandise, the outgrowth of the Coker farms commissary.

### Coker's Pedigreed Seed Company, 1901-1950

The scientific breeding of hardier more disease-resistant strains of cotton and other field crops, producing greater

yields and increased value was at the center of the agricultural revolution of the 20<sup>th</sup> century. The rediscovery in 1900 of the laws of plant genetics discovered by Gregor Mendel some thirty years earlier allowed breeders to make remarkable improvements in crop performance. One of the earliest applications of this discovery was by David Coker, who began his experiments to evaluate cotton varieties and study plant response to soils and fertilization in 1898. From these experiments he suspected that hereditary factors in plant, as in animals, could be passed on and strengthened through the process of selection and testing. About this time, the Cokers became acquainted with Dr. H. J. Webber in charge of the USDA's Department of Plant Breeding in Washington and invited Dr. Webber to visit Hartsville. This visit and professional relationship eventually led to Dr. Webber working closely with Mr. Coker in what was to become the first scientifically based plant breeding program following the rediscovery of Mendel's laws of inheritance. In 1901, Mr. Coker selected 30 individual plants of cotton from a field of Jones Big Boll. These were planted in 30 plant to row progenies in 1902 and the Coker tradition in plant breeding had begun.

When Mr. Coker began this program, American upland cottons were short stapled, low yield, wilt susceptible and left much to be desired in overall manufacturing quality. These obvious deficiencies plus the desire to improve the overall well-being of southern agriculture, were the basis of Mr. Coker's early breeding objectives including (1) increased productivity, (2) improved fiber quality, specifically length and spinability, and (3) enhance the overall profitability of cotton production to the rural South. At this point, Mr. D. R. envisioned his crop improvement programs as a public service with no real expectations of developing into a profitable business venture.

To further illustrate Mr. D. R.'s emphasis on improved profitability through quality, the following statement is taken from a paper delivered by him before the South Carolina Textile Manufacturer's Association in 1908.

"Under present conditions there is little use for the breeder to offer seed of a 1 1/16" to 1 1/8" variety for he cannot assure the farmer that he will receive any more than his neighbor is getting for 3/4" to 7/8" staple." He further stated, "The real value of a pound of cotton is the sum of its spinning qualities and when the spinning value and that alone everywhere determines the price, inferior and undesirable varieties will quickly disappear and improved types will take their places." This was in 1908.

In 1911 he used the following expression, "The matter of length and uniformity of cotton is of such paramount importance that it would seem that the whole system of buying short staple cotton should be changed and that the staple of every bale should be determined before sale and become a factor in its selling price."

These points were repeated in a 1921 address before the World Cotton Conference in Liverpool.

In 1908, Mr. George Wilds, a young college student, came to Hartsville to assist Mr. Coker in this rapidly expanding program. Mr. Wilds later took a leave for graduate studies at Cornell University, where he received a degree in plant breeding. It was through the untiring efforts of such dedicated scientists as George Wilds and Dr. H. J. Webber, who came with Coker's after his retirement from the USDA, and others that Coker's was able to make such phenomenal progress.

Working with such a wide range of diverse unselected types over a period of years, resulted in numerous varietal releases representing significant improvement in virtually all traits. Among these were many well-known widely grown varieties including Coker Hartsville, Super Seven, Clevevilt, Farm Relief, Lightning Express, Coker Wilds, Deltatype Webber, Coker Foster, Coker 100, and Coker 100 Staple. These and other developments were largely responsible for the rapid expansion of cotton production and were a stabilizing influence on the expanding textile industry. Of these, Coker Hartsville, Coker Wilds, and Coker 100 are perhaps the best known. Years later, one of the lines of Hartsville variety was recognized as a potential source of Verticillium wilt tolerance and Coker Wilds for its superior fiber quality with staple length averaging 1 1/4". These traits were presumed to be the result of introgression from barbadense.

In 1918, under the managerial and business skills of Mr. A.L.M. Wiggins, the plant breeding activities were officially incorporated as Coker's Pedigreed Seed Company and what had functioned primarily as a public service entity was finally put on a business basis.

Unfortunately, the 10 to 15 years following incorporation of the company proved to be some of the worst economically. The coming of the boll weevil with devastating effects on the later maturing, high quality varieties, compounded by the great depression of the late 1920's and early 1930's was disastrous to producers as well as the emerging pedigreed seed business. Many farmers lost everything and the seed business, having gone several hundred thousand dollars in debt, was salvaged at the risk of the private funds of the Coker family.

I can personally attest to the financial impact of this period when as a 10 or 12 year old on a small farm in lower South Carolina, I saw our meager cotton production sell for 5 cents a pound.

With financing for purchase of pedigreed seed almost nonexistent, Mr. D. R. turned to a novel approach for seed marketing. This involved farmer purchase of limited supply, perhaps one bag of pedigreed seed with which he planted a seed patch. From this, he not only planted his

entire crop the following year, but in many instances, an enterprising grower would supply his neighbor's also. While initially beneficial in expanded seed sales and benefiting the entire farm economy with readily available first year from breeder seed, it eventually became a major source of competition for the costly breeding program. Ultimately, the seed certification program followed in the 1970's by Plant Variety Protection, helped alleviate this competition.

In 1942, Dr Wilds employed Dr. C. Hoyt Rogers to strengthen Coker's research team in Plant Pathology and Plant Breeding with emphasis on tobacco and cotton. Dr. Rogers, a 1926 graduate of Clemson University, received his PhD in plant pathology from Rutgers in 1930 and pursued this field at Texas A&M where he worked with Dr. Beasley on the Triple hybrid program. When he moved to Coker's, Dr. Rogers brought with him some of the 3 H material. Between 1942 and 1959, he established a small cotton project around this germplasm and other exotic materials. However, with the growth of interest in tobacco, this became his primary focus and all cotton breeding was consolidated into one program.

It was also in 1942, that the real breakthrough in cotton came with the introduction of Coker 100 Wilt, developed by Dr. Wilds and associates. IT was this achievement which prompted the following statement in the USDA 1953 Yearbook of Agriculture: "The long efforts of breeders to produce agronomically superior wilt resistant varieties was climaxed in 1942 with the introduction of Coker 100 Wilt. It was as productive as the best nonresistant variety and had other desirable characteristics such as the medium staple length, earliness, and adaptability to a wide range of growing conditions." This variety represented a significant transition from a flood of diverse varietal types to acceptance of superior pedigreed material. As recent as the late 1920's it was estimated that some 500 varieties were planted in the United States. In 1952, 89% of the U.S. acreage was planted to only about 10 varieties. At the same time, statistics indicate that better than 98% of the acreage in Virginia, North Carolina and South Carolina was planted to Coker 100 Wilt with from 40-80% in other Southeast states. From 1921-25, South Carolina's average yield was 180 pound per acre increasing to 314 pounds for the 1943-52 period. Today, the average yield in the Southeast is probably close to 800 pounds per acre with many producers running 2 to 3 bales. While much of this increase may be attributed to improved varieties and management, much is the result of boll weevil eradication and improved insecticides.

### **Southeast Production Environment**

At this point, it will be helpful to look at the general production environment of the Southeast. Rainfall, while very variable, generally averages some 45-55 inches per year. Temperatures during the growing season may range

from the 80°'s to 100°+. Planting season is frequently cool and wet, favoring seedling diseases, with harvest complicated by hurricane weather. Soils of the Coastal Plains are generally sandy, quite acid, low water holding capacity, low in fertility and infested with the Fusarium wilt-nematode complex. As a direct result of these environmental pressures, a number of the early varietal releases had at least moderate tolerance to Fusarium, as well as the other prevailing stress conditions. In an effort to enhance performance, screening trials were located over several counties around the Hartsville area. At one of these, Dr. Wilds observed "wilt" susceptibility in lines previously considered tolerant. He initially presumed this to be a new race of Fusarium. However, further studies indicated a heavy infestation of nematodes presumably other than the widely occurring root-knot species, probably sting. This experience clearly indicated the value of multi-environmental evaluation that has been continually expanded over the years.

During the late 1940's Dr. Wilds expanded the company's cotton program with the establishment of a branch station in Lake Cormorant, Mississippi, under the supervision of Mr. H. M. Larrimore, a Hartsville native. The objective was two-fold: (1) to develop varieties especially adapted to the Mississippi valley, and (2) to significantly increase the scope of the testing program, thereby widening the range of adaptability of Coker varieties. During the late 1940's and 1950's the Mid-South program evolved into a full scale breeding program with extensive performance trials in the Mississippi Valley plus intensive Fusarium-nematode screening and yield trials in southeast Missouri. It was from these plantings in Missouri that the exceptional potential of Auburn 56, for those sandy Fusarium-nematode soils, was recognized by Coker breeders and Dr. Bill Sappenfield of the Missouri station. Subsequently, Auburn 56 was marketed commercially in that area as Auburn M, and later a selection made by the McNair Seed Company in North Carolina was distributed in the Southeast as McNair 1032.

### **Other Cottons of the Southeast**

Let us depart from the activities of Coker's Pedigreed Seed Company to address the status of other private breeders of the Southeast during this period.

In 1918, Mr. K. W. Marett of Westminster, South Carolina, in collaboration with Dr. Carberry of Clemson College initiated a cotton breeding program with the specific objective of developing varieties adapted to the Piedmont Region of South Carolina and similar Southeastern environments. According to his nephew, W. T. McClure, Jr., who succeeded Mr. Marett, one of the first varieties developed there was Cleveland Big Boll. Subsequent varieties included White gold and White Gold Wilt. As cotton acreage declined and competition increased, the Marett breeding activities were terminated about 1950 and

germplasm transferred to Coker's. I might add here that I had my introduction to applied breeding, working with small grains at AMretts, during 1947-1950 after returning from military services in Europe during World War II.

During that same period, the Wannamakers of St. Matthews, South Carolina became active in breeding cottons for that region of the state. Mr. W. W. Wannamaker developed several varieties including Wannamaker Cleveland and All-in-One, which became popular in areas of South Carolina, Georgia, and Alabama. Mr. Wannamaker was succeeded by his sons, Wes and Joe, who continued the plant breeding and seed production programs for several years.

The McNair's of Lauinburg, North Carolina, were primarily producers of certified seed of Coker varieties for a number of years. They became active in cotton breeding around 1950. The McNair breeders, David Burns, and Dr. John Green, developed a series of varieties including McNair 1032, an early maturing Fusarium-nematode tolerant selection of Auburn 56, referred to earlier, plus McNair 220 and McNair 235 from a cross involving a Pee Dee line and a Coker variety. These McNair varieties were widely grown throughout the Southeast for a number of years. The McNair varieties and breeding stocks were later sold to the Northrup King Company and are no longer on the market.

In Georgia, Mr. W. W. Ballard was involved in cotton breeding with the Georgia Experiment Station and released the Empire variety. After Mr. Ballard's retirement, he became affiliated with Mr. Bill Estes of Georgia and the work with Empire was continued for a number of years on a private basis.

### **Coker Cotton Program 1951-1988**

Dr. James Winston Neely, a native of Cotton Plant, Arkansas, and a 1928 graduate of the University of Arkansas receive the PhD in genetics from Cornell University in 1934. Following his graduate, he was employed as geneticist by the USDA at Stoneville, Mississippi, 1934-45; Plant Breeder, Stoneville Pedigreed Seed Company, 1946-51; and as Director of Research, Coker's Pedigreed Seed Company, 1951-71.

In September 1951, Dr. Neely and Dr. Wilds invited me to join the Coker program with primary responsibility in cotton breeding. As research director, Dr. Neely routinely encouraged his associates to analyze problems, explore opportunities and learn by personal experience. He was always available to listen to ideas, and encourage any logical approach to solutions. One could not ask for a finer supervisor, friend, and mentor.

In October 1951, Dr. Wilds succumbed to a heart attack and Mr. Robert Coker, son of David Coker, became president and Dr. Neely, Vice President. Under Dr. Neely's

guidance, the cotton breeding program was reorganized and greatly expanded. Work with current Coker varieties was intensified, new germplasm introduced, and additional facilities and equipment acquired.

During those earlier years, Dr. Wilds was able to make rapid and significant varietal improvement primarily through visual evaluations, with minimum performance trials.

By the time Dr. Neely arrived at Coker's, much more sophistication in selection and evaluation was required. The new direction of the 1950's included a classic pedigree program, covering a period of some 8 to 9 years for variety maintenance, and correspondingly more for selections from new hybrid combinations. This program was oriented toward approximately 60% maintenance and 40% new varietal development. Over a period of years, as varietal improvement through maintenance selection decreased, a gradual shift to primary emphasis on new varietal development occurred. Concurrently, the range of environmental evaluation of germplasm was extended to enhance expanded adaptability.

Although the maintenance program was designed to permit the introduction of improved single lines, it more frequently resulted in a maintenance combination of related lines capable of overall improved performance. This approach also had the potential for meaningful yield enhancement when produced in a geographic area with high pollen vector populations. Natural crossing of up to 25-30% was not unusual in our primary production area, the Piedmont Region of the Carolinas, and contributed to enhanced performance.

In 1964, the site of the original research plantings by Mr. D. R. Coker was recognized as a National Historic Landmark. The marker still stands on that site.

Following the program expansions of the early 1950's several excellent young breeders came through the Coker Program. John Hicks, a native of South Carolina, who came with Coker" with a BS in Agronomy from Clemson University, developed into an outstanding plant breeder in cotton and soybeans. While at Coker's, John was able to pursue graduate work at North Carolina State University studying with Dr. Josh Lee. His breeding emphasis at Coker's was primarily on specific projects, such as Fusarium wilt-nematode tolerance, bacterial blight resistance, insect resistance, glandless, as well as increased gossypol, nectariless, glabrous, and hybrid development. Dr. Hicks is currently employed by the Pioneer Seed Company as Soybean Breeder in the Mid-South.

Shelby Baker, a native of Alabama with an MS in plant breeding from Auburn University joined the Coker cotton program in the 1960's. After a number of years with Coker's, Shelby moved to Tifton, Georgia, where he has

continued to make significant contributions to Southeastern cotton improvement. Several other young breeders made major contributions to Coker's cotton programs at various locations. These included Lloyd Langford, Lynn McDonald, and John Boswell.

When the winter nursery program was established at Iguala, Mexico, around 1950, Coker was among the first to take advantage of this potential for speeding up varietal development and release. In 1951, we were able to identify several promising lines from our Mississippi program, including the Coker 124 type. Ultimately, we released several widely adapted varieties from this material, including Coker 310, the first cotton variety to be approved for Plant Variety Protection, with a Certificate issued in January 1974. This was one of our most successful cottons, noted for total yield, above average fiber quality, earliness, machine pickability, resistance to the Fusarium-nematode complex and moderate tolerance to Verticillium wilt. Coker 310 established itself as a significant contributor to production in the Southeast, Mid-south, Far West, Mexico, Spain, and areas of the Middle East. Subsequent releases of Coker 310 related material included Coker 4104 and Coker 5110, noted for Verticillium tolerance, excellent fiber quality and moderate storm resistance. Both were grown extensively in the Mid-south and the Texas High Plains. Coker 5110 proved to be well suited to Ecuador and became a predominate variety there for several years. Coker Carolina Queen released during the early 1960's originated from a cross of Coker 100 Wilt x Empire. This variety preceded the release of Coker 310 by about 8 years and became widely grown during that period. It was as wilt tolerant as Coker 100 Wilt but earlier maturing, more determinate and with boll characteristics similar to Empire. It was exceptionally attractive. A subsequent selection of this variety was marketed as Coker 201. Having unusually broad adaptability, Coker 201 became a favorite throughout the Southeast and in the mid-East where it was a preferred variety for many years, especially in Syria.

During the late 1950's, we identified a smoothleaf plant in a progeny row from the cross of Coker Wilds x Coker 100 Wilt. This line had good yield potential, enhanced cleanability, and superior manufacturing quality, approximately equal to the California Acalas.

When released for farmer production, as Coker 413, in 1967, manufacturers were aggressively seeking improved quality and eagerly sought out this production paying premiums as high as 812 cents per pound. Unfortunately, these premiums did not last and growers soon switched back to old standards. While Coker 413 was short lived, it stimulated increased emphasis on development of improved quality and a system for rapid quality evaluation, ultimately attaining one of Mr. D. R. Coker's early objectives. Today the High Volume Instrument Testing System addresses the problem of rapid evaluation and has been of significant value in marketing.

Two additional somewhat similar varieties to evolve from Coker 310, during the 1970's were Coker 304 and Coker 312. Coker 304 was similar to C-310 in fiber properties but was moderately earlier maturity with higher gin turnout. Coker 312 was earlier maturing with coarser fiber and a more storm resistant boll, resulting in its designation as a High Plains variety. As most of us are now aware, Coker 312 has also demonstrated a unique adaptation to bio-tech gene transfer programs and is probably the basis for most, if not all, such varietal releases in or near production status today.

During the 1960's and 70's, Coker's cotton breeding activities continued to expand. At Hartsville some 100 acres were devoted to cotton research, with approximately 30-40 acres at both Tunica, Mississippi, and Lubbock, Texas, with field trials in Mexico, Arizona, and California.

In 1963, a cooperative program in variety maintenance, seed production, and marketing was developed with a Spanish group designated as COPSA. This developed into a strong alliance for Coker with essentially all cotton production in Spain planted to Coker 310 for 10-15 years.

This expanded research, plus Coker's long-time commitment to quality, led to the development of a comprehensive fiber testing laboratory at our Hartsville headquarters. This proved to be a very valuable addition to our total program and contributed to Coker's continuing strong emphasis on quality.

In the early 1980's, Coker released Coker 315, probably the most outstanding and widely adapted variety in Coker's history. Coker 315 was out of a cross of Coker 310 x Coker 8103, a high strength line from the Coker 124 family. Unfortunately, with subsequent changes in company ownership, this variety was short lived.

Mr. Robert R. Coker, President since 1951, had personally experience many of the hardships of the cotton industry and long-term effects of the boll weevil on its survival. With the development of technology capable of eliminating the impact of this pest on cotton production economics, Mr. Coker immediately became one of its most enthusiastic supporters. He was subsequently designated chairman of the weevil eradication steering committee and worked closely with all aspects of the program. One of his often-stated objectives was to live to be a pallbearer at the funeral of the last weevil. He came close to making it. Few developments have contributed as much to the economics of cotton in the Southeast as the eradication of this major pest.

In 1979, Coker was purchased by the KWS Company of West Germany, a family-owned seed company with much the same background and research philosophy as Coker's;

however, we were able to continue to operate as Coker's Pedigreed Seed Company through 1987.

In 1986, Coker's employed Dr. David Howle, a Hartsville native with a PhD in plant breeding from the University of Arkansas to come to Hartsville to manage the cotton program. I retired in 1987. The company was sold to Northrup King in 1988 and the cotton program was moved to the Stoneville, Mississippi area prior to the 1989 season. Shortly thereafter, Northrup King Company sold the cotton germplasm and seedstocks to Stoneville Pedigreed Seed Company.

It is our opinion that valuable germplasm has been lost as a result of being transplanted out of its primary area of development, adaptation, and utilization. While established varieties would have continued to be well received by experienced Coker growers, it was not practical or economical to maintain and produce these southeastern types in the Delta environment and by personnel not basically familiar with this germplasm. The producers of the southeast lost a viable option in choice of varieties.

Following my retirement from Coker's, I continued as a

technical consultant with COPSA, our Spanish affiliate, until 1994. During my 36 years with Coker's and an additional 7 with COPSA, I attended all Cotton Improvement Conferences from 1952 through the 1994 conference here in San Diego. In 1958, I had the pleasure of serving as Chairman of the Conference.

At this point, I would like to express my sincere appreciation to the research and extension personnel of the southeast, and Dr. Tom Culp in particular, for their assistance and support during this almost 50 years in cotton breeding. Also to others across the Cottonbelt who so generously shared their expertise and germplasm contributing significantly to our program. It goes without saying that none of this would have been possible without the groundwork and contributions of those who preceded us in the Coker program.

I would also like to express my sincere gratitude to Dr. Calhoun and others responsible for affording me the opportunity to be with you for this 50<sup>th</sup> Anniversary meeting to discuss the 100 year history of private cotton breeding in the Southeast.