COTTON FOUNDATION 2002-2003

CHAIRMAN'S MESSAGE

The Cotton Foundation's vitality has never been more important as the U.S. cotton industry has been buffeted by low farm prices and cheap textile and apparel imports.

Foundation fiscal support – backed by strong allied industry membership - is helping the National Cotton Council brighten the industry's future. This is being achieved primarily by supporting the development of new technology and techniques that enable the industry to gain greater efficiencies and avoid unnecessary regulation.

Dues and special grants to the Foundation from its member firms coupled with investment income enabled the Foundation to underwrite 35 general cotton research and education projects for 2001-02 with $474,950. That increase from the previous year funded market development, profitability and regulatory projects ranging from cottonseed quality improvement to validation of remote sensing data.

A large portion of Foundation-supported work is driven by recommendations from the NCC's Profitability Initiative. In looking for ways to reduce production and processing costs, the initiative pointed to the potential of precision agriculture, genetics, biotechnology, conservation tillage and narrow row cotton. Among the study's conclusions was that from four to seven cents per pound in savings could be achieved from precision agriculture but further refinements of that technology are necessary. That study has led to major on-farm projects using remote sensing and variable rate technology in Georgia, Mississippi, Louisiana and California. Tests thus far have shown significant efficiencies in the application of plant protectants, fertilizer, water and other inputs. Further information on Cotton Foundation-funded profitability projects can be found on The Cotton Foundation's web site.

Foundation special projects, which are funded by member firms over and above their regular dues, continued at a high level of nearly $1.2 million. Multiple NCC-developed educational endeavors were launched this past year.

Cotton Counts, for example, is aimed at improving consumer attitudes toward U.S. cotton. Carried out primarily by National Cotton Women's Committee volunteers, the campaign's objective is helping America's students and the general public better understand and appreciate cotton and the U.S. cotton industry's contributions to the nation.

The industry also is gaining public recognition, especially from lawmakers and regulatory officials, through the World of Cotton. Located on the NCC's web site, this database provides comprehensive statewide data on U.S. cotton's economic significance.

Ongoing educational efforts were bolstered, too.

NCC's online *Journal of Cotton Science*, a peer-reviewed, refereed publication, received special project grant support to help it strengthen its reputation as a leading source for new scientific discoveries and studies.

Cotton Council International's COTTON USA Advantage program received additional funding, too. This is helping in the challenge to get overseas consumers to distinguish the unique qualities and services of U.S. cotton and U.S. cotton products.

The Foundation's involvement in helping the NCC achieve its mission is growing as special project support is being sought for more of NCC's core activities such as the *Cotton's Week newsletter*, the daily Cotton eNews and the *Cotton's Week* broadcast on AgDay. All special projects have been scrutinized to ensure they are helping NCC carry out its priorities.

By describing Foundation-supported research and educational activities, this annual report offers optimism. That progress coupled with the Foundation's recent strong membership growth and overall track record are reasons for believing this institution can help the NCC in its quest to restore U.S. cotton's viability.

James F. Dodson, 2002-03 Chairman
The Cotton Foundation

(Dodson served as 2001-02 Foundation president.)

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2002-03 PROJECT SUPPORT

GENERAL PROJECTS

Cotton Foundation Contingency Fund
Some Cotton Foundation general funds are retained to support high priority research or education needs that were not anticipated during project planning. In 2002-03, contingency funds supported: 1) Co-Host of Aflatoxin/Fumonisin Elimination and Fungal Genomics Workshop; 2) Sponsorship of Cotton Fusarium Wilt Research Workshop; 3) Consultation: Factors Affecting Usage of Cottonseed Cooking Oils by Snackfoods Industry; and 4) Research Project: Survey of U.S. Bale Density, Size and Package Performance In Export Markets.

SPECIAL PROJECTS

Special projects are funded by Foundation members over and above their regular dues.

GENERAL PROJECTS: MARKET DEVELOPMENT

Value-Added Uses of Cottonseed Products

Texas A&M University scientists are collaborating with USDA Agricultural Research Service scientists in New Orleans and College Station, TX, on work to significantly increase gossypol detection. They also are exploring additional non-food and non-feed applications of cottonseed products such as a cancer-inhibitor, a concrete mold releasing agent and an alternative fuel for automobiles to improve combustion efficiency and reduce pollutants.

Among findings thus far are that a motor oil formula containing 50 percent screw pressed cottonseed oil was almost 2000 times better than the standard motor oil in terms of lubricity.

Cotton Quality Task Force Initiative: Confronting Our Challenges

The NCC's Quality Task Force (QTF) provides a forum for consensus on initiatives needed to address critical quality issues confronting the U.S. cotton industry. Chaired by Alabama producer Jimmy Sanford, the QTF met and approved several research initiatives and practices that affect cotton quality, and these are ready for review by all cotton industry segments. For example, the task force unanimously adopted a recommendation on the micronaire issue that urged the USDA-AMS Cotton Program to: 1) report the results of its study of market discounts applied to Southeast and Mid-South cotton in the 4.8-4.9 micronaire range to the Research and Education Committee at the NCC's 2003 Annual Meeting and 2) continue to collect data on market discounts applied to Southeast and Mid-South cotton in that range.

The QTF also continues to: 1) identify action items requiring industry attention including loan schedule simplification, harvest and bale moisture management, pepper trash, short fiber measurement and sticky cotton and 2) focus the cotton research community's attention on these items.

The National Cotton Council's Quality Task Force provides recommendations to the U.S. cotton industry on issues ranging from short fiber measurement to loan schedule simplification.

Detection of Seed Cotton Contamination by Ion Mobility Spectrometry

Despite policing of fields at harvest, plastic contaminants need to be detected well before the textile manufacturing process because they are costing the U.S. cotton industry as much as $5 million annually. A miniature ion mobility spectrometer device was tested in a cotton gin as a means to detect even the smallest of plastic fiber contaminants in seed cotton during gin drying. USDA-ARS and New Mexico State University researchers identified the important volatile organic chemicals emitted by contaminating plastics during the drying stage and determined the appropriate detection limits.

Value-Added Nonwoven Cotton Products: Flame Retardant Cotton Blend Highlofts

The 9/11 tragedy brought a greater focus on safety and an effort to develop inexpensive flame retardant (FR) cotton fibers. These fibers are being used to produce FR highlofts, materials made with less fiber and more air. The highlofts, which provide excellent cushion and insulation, could replace polyurethane foam and be used in school bus and airplane seating.

The research is a continuation of work initiated at USDA's Southern Regional Research Center in New Orleans. Scientists will work with the Fred Clark Felt Company to develop and test FR highlofts that have excellent flame retardancy and soft hand. Researchers already have developed highlofts with and without blending with FR polyester fibers and made the highloft fibers more flame resistant and resilient.

Using the vertical flame test, the damage sustained during flame resistance tests on high lofts was limited to charring in the vicinity of the instigating flame.

GENERAL PROJECTS: PROFITABILITY: EDUCATION

Module Management Education Program: Building, Covering, Transporting and Tracking

The NCC updated its module education program based on information gleaned from a survey regarding current module management practices across the Cotton Belt. Among needs identified from the survey was getting ginners more information on advanced methods of identifying as well as tracking modules and module covers through the harvesting and ginning process.

Through this project, the NCC has been able to revise and distribute its "Just Tarp It" brochure, which also is available on the NCC's web site. NCC staff is working with other organizations on a companion document, "Just Build It," and is identifying technology with the potential for improving module identification and tracking.

A NCC-led module management education program includes disseminating information on proper covering techniques to prevent tarps from pooling rain water or being blown off by wind.

Electronically Publishing the Journal of Cotton Science

The quarterly, on-line *Journal of Cotton Science* (JCS), available at http://journal.cotton.org, offers ready access to multidisciplinary cotton research in areas ranging from genetics to economics. Offering scientists a rapid outlet for their findings, JCS has received and placed into peer review more than 250 manuscripts. Published manuscripts contain an interpretive summary that explains the value of the research in layman's terms.

JCS, which is copyrighted, is now published as Adobe Acrobat (PDF) files for optimum versatility and ease of publication. *JCS,* now in its seventh year*,* was the first all-electronic journal to be indexed in AGRICOLA, the database of the National Agricultural Library.

Enhancing Cotton Industry Education and Information through the National Cotton Council Web Site

The NCC's web site, www.cotton.org, is a cost-effective method of communicating, and is helping the organization handle increased information demands. Visitor traffic increased an average of 20 percent from mid-2002 through mid-2003.

Among improvements and additions to the site were: 1) helping NCC members contact their Representatives and Senators regarding NCC action alerts using an on-line lookup for U.S. Congressional members, 2) additions of the National Cotton Ginners Association and the Cotton Leadership Program sites and 3) moving *Journal of Cotton Science* to the NCC server to reduce hosting and updating costs.

The NCC's World Wide Web Project Team continues to guide the site's development as a central online information source about the U.S. cotton industry. Integration

GENERAL PROJECTS: PROFITABILITY: GENETICS

Screening Converted Race Stocks (CRS) for Cotton Seedling Drought-Tolerance

Texas A&M University researchers are seeking to verify the differences in seedling drought tolerance among converted cotton race stocks (CRS). They also are studying the genetics of seedling drought tolerance and working to transfer such genes to germlines. The aim is to provide information to breeders on how to design breeding schemes to capture additional drought tolerance in commercial cultivars.

Thus far, they have identified 10 CRS that exhibited 60 percent or better seedling recovery following three cycles of drought stress under greenhouse conditions. The seedling drought tolerance of at least two CRS was verified. They are exploring additional screening methods to identify seedling drought tolerance, including germination under high salt and chlorophyll florescence under drought conditions.

They also evaluated 68 of the CRS lines for their seedling root growth. In general, they identified distinct morphological differences among these CRS lines. Several displayed robust seedling root systems, and one of those was among the lines that previously had shown seedling drought tolerance in the greenhouse screen. They will continue to test their working hypothesis that root growth and drought tolerance during seedling development are two agronomic traits associated as a cause and effect relationship.

Determination of a Method to Break the Yield Plateau

There is a need to find a method to significantly increase yield without increasing production costs. Dr. Hal Lewis has provided some insight concerning this problem, and his methodology will be utilized by Dr. John Gannaway of the Texas Agriculture Experiment Station in an attempt to develop germplasm with significantly increased yield potential.

Work thus far has revealed that the weight of fiber per seed trait is heritable and controlled by several genes. This portion of the study will continue to further define this trait's inheritance. Twenty breeding lines with at least 90 mg lint/seed were performance tested in 2002. Some of these lines, along with some new materials, will be performance tested in 2003. This will provide more definitive data concerning their yield potential as a result of greater weight of fiber per seed.

GENERAL PROJECTS: PROFITABILITY: GINNING

Gin Management & Technology Program and Mini-Gin Enhancements

Foundation support has allowed equipment updates to a micro-gin at Mississippi State University - the only operational gin on a college campus. The gin, which features the latest available equipment, is helping extend the learning opportunities for students in the university's Gin Management & Technology (GMT) program. Students now can pursue a bachelor's degree in agricultural engineering technology and business with an emphasis in gin management and technology.

Brochures for the GMT curriculum were developed, printed and mailed to high schools in the five-state area represented by the Southern Cotton Ginners Association in an attempt to recruit students into the program. Several recruiting trips were made to high schools in Mississippi and presentations were made to prospective students.

Mississippi State University students helped install programmable logic controllers in a mini-gin to monitor and control speeds of shafts at the feed control unit and gin stand feeder.

Detection of Cotton Smoke by Ion Mobility Spectrometry

Early detection of fires is critical as the industry moves to plastic bale ties because the plastic ties may break at temperatures lower than those that activate current sprinkler systems.

USDA-Agricultural Research Service and New Mexico State University researchers have used advances made in ion mobility spectrometry selectivity to greatly improve the ability to detect cotton smoke – and minimize bale fire risk at warehouses. The team is: 1) setting up a fire bale detection system outside warehouses and zone deluge systems, where fire sprinklers are activated by a smoke detector that recognizes the unique "smell" of burning cotton and 2) sampling several smoke sources as a way to better detect cotton smoke from other combustion products.

Assessment of Gin Waste Constituents for Improving Gin Waste Handling and Quality

Fires in gin waste stacks continue to be a risk and an additional ginning cost, especially in the rain-prone Mid-South and Southeast cotton regions. University of Arkansas engineers are studying gin trash components to find a way to avert smoldering and spontaneous fires that often occur in deep stacks of gin waste. The team has looked at gin waste components such as cellulose, lignin, ash and sulfur as well as the components of oxidation and other biological degradation that could shed light on methods to eliminate fires, especially if auto-ignition is possible in deteriorated or partially-composted gin waste. During their investigation, the scientists also looked for opportunities to evaluate the suitability of gin waste for higher-value end uses.

GENERAL PROJECTS: PROFITABILITY: INSECT CONTROL

Possible New Strains of Fusarium in the San Joaquin Valley of California: Support for Field Evaluations

Work initiated in 2002 was aimed at: 1) identifying field sites for *Fusarium* investigations in San Joaquin Valley cotton by scouting fields and through contacts with growers and consultants, 2) providing follow-up evaluations to look for symptoms in the field and 3) sampling plants to confirm *Fusarium* infection and site characteristics (soil type, cotton variety), allowing identification of different groups or strains of *Fusarium*.

A new and potentially damaging *Fusarium* strain has been identified in two clay loam sites in California's San Joaquin Valley. Results to date suggest that identification of significant *Fusarium* injury to certain Pima varieties in clay loam soils without the presence of significant root knot nematode populations is not necessarily an indication that newly-introduced virulent strains are being found in there. The data may indicate instead that certain Pima varieties tested thus far may be much more susceptible when exposed to specific existing California strains than some Acala cotton varieties when grown in those same soils. It is important to note that to date, analyses of samples collected in 2001 and 2002 have not identified the presence of either of two damaging Australian strains of *Fusarium* in sampled San Joaquin Valley cotton fields.

Development of an Economic Model for Cotton Insect Management After First Flower

University of Arkansas and Arkansas State University scientists determined that high night temperatures are one of the major causes of lowered, more variable yields in the Mississippi River Delta. There was no significant effect of raised or lowered night temperatures on final boll weight or fiber weight, but there was a numerical trend for elevated night temperature to decrease fiber and boll weight, which supports their hypothesis of high night temperatures being detrimental to developing boll weight.

Decreased boll weight would presumably be related to a shortage of carbohydrates for boll growth. It has been suggested that this would partly account for lowered yields in Arkansas during periods of high night temperature, but additional research with modifications to the protocol are needed to prove this hypothesis. There was no significant effect of altered night temperature on night respiration.

Specific findings were: 1) a strong correlation was shown between high temperatures and low yields, 2) yields decreased above a 74^{o}F night temperature threshold, 3) boll weights from positions three and greater were decreased 5.7 percent by high temperature, 4) temperature treatment did not appear to affect total number of bolls per plant, 5) Greece has similar production practices and varieties to Arkansas, but twice the yield, due mainly to 8^{o}F lower *night temperatures* (similar day temperatures), 6) elevated night temperature in the Mid-South decreased the weight of fiber per seed and 7) one week of elevated night temperature during the fourth week of flowering did not significantly affect boll weight as the plant was able to compensate during the remainder of the season.

An air conditioner blowing cool air decreases the cotton plant's canopy temperature and enables researchers to study night temperatures' effect on boll growth and development.

Cotton Insect Hotline

The Cotton Insect Hotline provides access to timely cotton insect situation reports, notification of field days and other in-season meetings.

Because of advances in electronic communication, only Alabama (by phone) and Arkansas (web site) used this service in 2003 to disseminate collected insect data on budworm and budworm species composition and resistance information. Entomologists in Alabama relay information on moth flights and resistance monitoring, while those in Arkansas assemble information from surrounding states on moth monitoring to keep growers in that state informed on population levels and movement.

Survey of Cotton's Losses to Pests

Annual estimates of cotton losses due to specific disease, insect and weed pests are made broadly available to public and private sectors. The Cotton Belt data, gathered at the Coordination Center at Mississippi State University, are useful for: 1) analyzing the market potential for new plant protection products, 2) establishing the importance of currently registered products that are threatened by cancellation or use restrictions and 3) setting research and educational priorities.

This loss data also is extremely important with regard to planning, funding and directing research by the public and private sectors. For example, the escalated use of Bt cotton raises concerns among entomologists and farmers about the bug complex becoming the most destructive insect pests of cotton, displacing the *Heliothines*.

The databases of 1978-2002 insect loss and weed loss data and the 1952-2002 disease loss data have been completed. This information was published on the 2002 Beltwide Cotton Conference Proceedings CD-ROM, placed on the NCC web site for downloading and made available to others requesting the database.

Entomologists are concerned that this tarnished plant bug and other bug complex members are becoming the most destructive cotton insect pests, displacing the *Heliothines*.

Management Impacts on Crop Microclimate and Arthropod Populations in Arid/Semi-Arid Environments

Scientists at New Mexico State University thus far have found that bollworm hatch rates fsuggest that the impact of low relative humidity and high termperatures may be more variable and less intense than effects on boll weevil. This is not surprising because bollworm is found in the crop canopy where temperature is lower than on the surface.

They also found that in general row orientation and row spacing could influence bollworm survival. Mid-late season conditions are more favorable for bollworm than early season, In early September 81 percent and 91 percent of bollworm eggs hatched in rows oriented north-south and east-west respectively. Bollworm egg hatch was reduced slightly in 96 cm rows comparted to 34 cm and 17 cm row spacing with 69 percent hatch in 96 cm rows compared to 84 and 89 percent hatch in 34 and 17 cm rows, respectively.

Objectives for 2003 work were: 1) determine the impact of plant node and position on seed quality, 2) relate characterizations of egg damage to specific predators, 3) determine the effect of irrigation timing and plant population on insect pest egg hatch rates and 4) determine the effect of temperature and relative humidity on development of beet armyworm and cotton bollworm.

Evaluation of Lygus Bug Resistant Cotton Germplasm

Lygus is fast becoming a major cotton pest due to increased resistance to some insecticides and to reduced insecticide applications resulting from widespread Bt cotton acreage.

Scientists at the University of California-Davis are working to assemble a plant gene shown to be a potent inhibitor of the causal agent of Lygus damage. They plan to introduce this plant gene into Max-R lines through their newly developed "short-cut" cotton transformation method. The goal is to provide transgenic plants screened positive at the molecular level to collaborators for seed increase, testing and evaluation in 2004.

GENERAL PROJECTS: PROFITABILITY: PRECISION AGRICULTURE

Remote Sensing Support of Precision Farming in the Texas High Plains

Texas Tech University and Texas Agricultural Experiment Station researchers now have acquired two years of airborne multispectral imagery of cotton fields in Texas' High Plains. Imagery will be acquired during the 2003 and 2004 growing seasons for the fields observed during the first two years of this study (2001 and 2002). Having additional complete years of remote sensing imagery will allow better determination of year-to-year consistencies.

Analysis of the image data acquired thus far in conjunction with mapping data acquired for the same fields has shown a strong correlation between the remote sensing data and the variability in yield and soil characteristics. This correlation is strongest during mid-season, so that the remote sensing data shows a predictive capability in terms of cotton yield at harvest. With proper analysis, scientists believe this mid-season remote sensing imagery can act as a "potential yield map." Such information can indicate to the farmer how to distribute management resources during the latter half of the growing season to protect the field's yield potential.

As a result of this study, remote sensing data now can be used operationally to direct the variable-rate application of the growth regulator (Pix) to the cotton crop. Researchers also continue to: 1) work on developing techniques for calibrating and analyzing remote sensing image data and 2) collect and analyze seed cotton samples for fiber quality. Data is used to produce detailed maps of fiber quality for these fields, and may be used to suggest possible methods for managing boll maturity.

Precision Farming Technology for Developing Subsoiling Guidelines in Arkansas

Selective subsoiling of compacted fields or compacted areas in a field could save up to $15 per acre on production costs. University of Arkansas and Arkansas State University researchers' preliminary observations in the Midwest and eastern Arkansas indicated that soil compaction could be detected with remote sensing. Their work on Jim Hughes' Arkansas farm is to determine if sensing technologies can be combined with the spatial analysis and modeling capabilities of GIS technology to develop a field monitoring and decision support system for identifying compacted soils.A primary objective in 2003 was to evaluate soil mapping and remote sensing technology for identifying soil compaction levels in the field, and to develop subsoiling guidelines for Arkansas cotton production.

Database Development Project for Ground Image Sensor Based Variable Rate Applicaton System

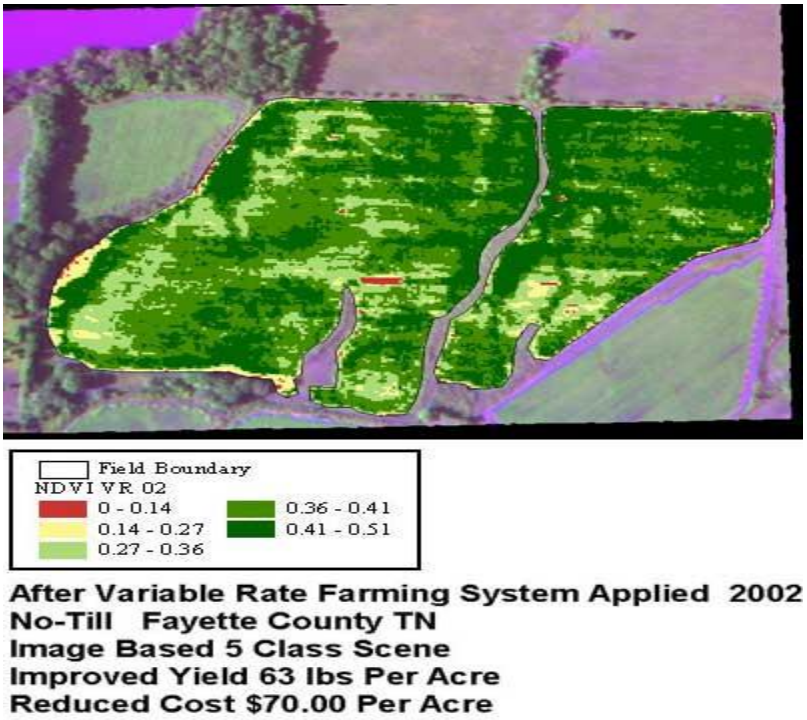
Louisiana State University researchers are working to develop spatially variable pesticide applications based on remote sensing. Current findings indicate that insect pest densities are weakly correlated with remotely sensed data. Additional GIS data, however, suggests that parameters such as historical yield and surrounding ecosystem can be incorporated with the remotely sensed image to develop a prescription for a variable rate insecticide application.

Because plant growth and development is strongly correlated with the remotely sensed image, spatially variable applications of plant growth regulators and defoliants can be made based solely on the remotely sensed image. Evaluation of these inputs indicates that plant growth regulator and defoliation costs can be reduced by at least 20 percent without significantly affecting lint yield or quality.

Reducing Cotton Production Costs Using Remote Sensing and Spatially Variable Insecticide/Defoliation (SVI/SVD) Technologies

A new sensor based variable rate control system developed by Oklahoma State University for wheat production has the potential to reduce cotton production costs from $60 to $150 per acre. A team of researchers from Jackson State Community College, Oklahoma State University, the University of Tennessee and USDA's Agricultural Research Service is working to create the database of information that allows the system's use in cotton production.

In 2002, four paired research fields and 700 acres of production acreage in a complete variable rate production environment were successfully managed. Imagery from year 2001 was utilized to design crop production zones that were the basis for 2002 variable rate production activities. For the entire 2002 production year, all planting rates, in-furrow fungicide, in-furrow insecticide, plant bug, stink bug, plant growth regulator (Pix) and crop termination treatments were image based variable rate applications. Pre-plant fertilizer was applied at a variable rate based on soil test data. The end result was a cost savings of more than $60 per acre with a yield increase of 63 lbs. per acre, yielding a total return to the grower of $90 plus per acre.



This multispectral image shows five production zones from low (red) to high (dark green) in a no-till cotton field in West Tennessee where variable rate input application was used.

Integrating Remote Sensing Technologies and Variable Rate Application Tools to Improve Cotton Production Efficiencies

A University of Georgia Precision Ag Team found that water distribution, even in irrigated land, was the primary controlling factor in improving southeastern U.S. cotton production and quality. They developed a reliable way to deliver optimum amounts of water over an entire field using a center pivot (the Southeast's primary irrigation method). The system was developed in partnership between the university, the Southeastern Cotton Growers Association and an electronics control company.

Believing that input use efficiencies of up to 20 percent can be achieved, the team now is focused on developing a rapid, cost effective system that can give growers a reliable estimate of the impact a variable rate irrigation (VRI) system would have on a field. In 2003, they were using both aerial and satellite image providers and targeting up to 50 fields in southwest Georgia to determine the percentage of fields that would benefit from VRI. Another project goal for 2003 was to couple the VRI system to a wireless soil moisture sensing system that monitored water needs for each part of the field.

Evaluation of Advanced Hyperspectral Remote Sensing for Detection of Cotton Water Stress

A University of California-Davis multi-year effort is aimed at development of precision irrigation systems that save water while improving crop yield, and ultimately increasing profits.

Researchers have used NASA's Advanced Visible/Infrared Imaging Spectrometer (AVIRIS) to acquire hyperspectral imagery on Ted Sheely's San Joaquin Valley farm. Spectral measurements in the field and on samples in the laboratory were used to build a model to enable measurement of soil mineral composition regardless of water content. This could lead to a break-through in measurement of soil-water interactions, which would be determined using airborne and satellite imagery, and provided to growers for precise field management.

Their 2003 effort will finalize the analysis of an extensive AVIRIS dataset for the determination of the within and between field variation throughout the cotton crop growth year and its relation to yield. Weekly imagery for real time determination of water stress indices will be acquired and provided to Sheely to bolster irrigation management during the summer season. The datasets then will be utilized to determine the efficacy of the COTONS model in predicting yield at a relatively early stage in the growth season.

GENERAL PROJECTS: PROFITABILITY: PRODUCTION RESEARCH

Cotton Management Systems Utilizing Subsurface Drip Irrigation and Conservation Tillage on the Texas Rolling Plains

As state and national water resources diminish and demand for water increases**,** a long-term management plan for water conservation and utilization is essential if irrigated production agriculture is to survive in the Texas Rolling Plains. Subsurface drip irrigation (SDI) is the most efficient and may now be competitive with traditional center pivots on smaller acreage.

In a 2002 trial, Texas A&M University researchers found that on average the 40-inch drip line spacing averaged 14 percent more yield than that from conventional furrow irrigation. In 2003, the scientists will characterize plant development, insect activity, weed management, lint quality and yield under subsurface drip irrigation utilizing a conservation tillage system and compare results with those from a conventional, furrow-irrigated tillage system.

A drip irrigation system was installed at the Munday Research Station in West Texas ahead of cotton planting in 2002.

Expanding Kansas Cotton Production Research and Education Programs

Kansas cotton production is escalating as a record 110,000 planted acres were expected for the state in 2003. Kansas State University Extension agents are developing a cotton production information base applicable to the state's higher elevation cotton growing regions and building an infrastructure of information disseminators.

Replicated variety trials were established on two farmers' fields in 2002. Farmer and consultant training tours and cotton seminars were held, and the first Kansas State University Extension Cotton Research Report was published and distributed in the spring of 2003. The 2003 Kansas State University Research & Extension Cotton program included a series of 10 county variety demonstrations, four on-farm replicated population studies and one replicated double-cropping study.

This Kansas date-of-harvest cotton test plot received severe hail damage at the three-leaf stage but got timely August rainfall to produce a harvest of 1019 pounds per acre.

GENERAL PROJECTS: PROFITABILITY: QUALITY

Maintaining Cotton Lint and Seed Quality During Module Building and Storage

A Texas A&M University researcher, in coordination with NCC staff, continues to evaluate the performance of new and used cotton module cover materials for: 1) resistance to the formation of defects and 2) moisture penetration. Other objectives include evaluating and refining the operation of an inexpensive module shape feedback monitor and evaluating the interaction of module shape and the moisture resistance of the cover in protecting seed cotton.

Some covers already have been evaluated, assessed for pin-hole density/material defects and selected for specimen evaluation in water resistance tests. Rain testing is underway with first indications that considerable amounts of water penetrate through new cover specimens where side seam stitching has not been heat sealed. Databases describing covers and associated performance are being developed. The information eventually will be provided to module cover manufacturers, ginners and producers. Data also will be shared with an engineering professional society to aid in updating obsolete cover standards.

Texas A&M University researchers inspect new and used module covers on a light table and categorize them based on condition prior to cutting samples for water penetration tests.

Shirley Analyzer Modifications for Fiber, Trash and Dust Collection For Further Separation

Work at the USDA-ARS Cotton Quality Research Station in Clemson, SC, was aimed at quantifying and categorizing dust and trash particles in cotton as they related to high-speeding textile spinning. Scientists sought to determine fiber contamination and understand how each contaminant fraction changes through processing.

The Shirley analyzer was used to collect waste from cotton from three growing regions while the cotton was cleaned, processed and spun. The waste material was studied to help in understanding the effects of growing region, cotton type, trash distribution and size on high speed processing. This research determined that a Prototype Shirley Analyzer (PSA) could separate cotton dust, trash, and fiber. Coupled with the PSA is the use of sieves that separates trash particles to better establish problematic trash types.

Detection of Volatile Gas Emission from Insect Honeydew as a Rapid Measurement of Cotton Stickiness

Another project conducted at the Cotton Quality Research Station was aimed at developing a rapid, cost-effective sticky cotton identification method for potential use by growers, ginners, merchants, mills and scientists. Insect honeydew contamination of cotton lint can interfere with carding, roving and spinning processes at the mill, and thus presents a major textile industry concern.

Researchers found that by heating a small sample of cotton, the sugars present in honeydew undergo a chemical reaction producing volatile compounds. The work in 2002-03 focused on: 1) characterizing and quantifying honeydew contaminated cotton samples as a function of heating temperature and honeydew origin and 2) developing a prototype portable instrument that would allow a rapid stickiness level determination based on the small sample heating/emission detection.

GENERAL PROJECTS: REGULATORY ISSUES

Commercial Use of Atoxigenic Strains to Prevent Aflatoxin Contamination in Arizona

Aflatoxin contamination of cottonseed costs farmers $30-$50 per acre in Arizona but no reliable prevention methods exist. With the help of the NCC and the IR-4 Biopesticide Program, permission was granted to treat 20,000 acres of Arizona cotton with *Aspergillus flavus* AF36 in 2003. AF36 is an atoxigenic strain of *Aspergillus flavus* that out competes aflatoxin producers in cotton fields, and it was granted full registration by EPA in June 2003.

In 2002, under the direction of USDA's Agricultural Research Service, environmental conditions under which atoxigenic strains perform best were defined and an assay to assess product survival in non-sterile soil was developed. This assay has been continually applied to improving the AF36 manufacturing process. Crop assessments continued to demonstrate the ability of atoxigenic strain applications to reduce aflatoxin-producing potential of fungi associated with the harvested crop. In 2003, the commercial-scale AF36 manufacturing process will be improved and quality control procedures simplified. Other objectives will be to: 1) assess the long-term efficacy of area-wide treatments, 2) identify agronomic practices favoring atoxigenic strains and develop recommendations by which producers can determine optimal application periods, 3) continue to investigate the impact of application timing and method on efficacy and 4) develop procedures to adapt the technology to areas with previously untested production characteristics such as reduced tillage and alternative irrigation practices.

Reduction of Aflatoxin Contamination in South Texas

Research continues on determining the incidence and distribution of various types of *Aspergillus flavus* in South Texas. The most effective strain at displacing aflatoxin producers in all test years was the atoxigenic strain AF36, the same strain used in Arizona. With the help of the IR-4 project and the NCC, an experimental use permit was granted for Texas for the 2003 crop year, allowing for treatment of 2,000 acres. Data from the first three years (2000-02) of this project were submitted to the EPA and used as the basis for including Texas on the full registration label for AF36, which was granted in 2003.

Crop-incidence fungal data collected from 1999-2002 is being incorporated into a geographical information system. In 2002 geostatistical analyses were performed on the toxin data, and regions with the most severe perennial contamination were identified. Analyses also described the importance of environmental parameters to cottonseed contamination in Texas and found, for example, that: 1) rainfall in July was the most important parameter and 2) corn cobs were an important source of *A. flavus* in cotton fields previously planted to corn. Among 2003 project objectives was detailing corn cobs' importance in providing overwintering inoculum for infection of cotton crops and describing the cobs' importance to the epidemiology of aflatoxin contamination of cottonseed.

Aerial applicators load a plane with AF36 colonized wheat seed before treating South Texas cotton acres

with that aflatoxin-competing strain.

Information and Research on Potential Consumer, Environmental and Workplace Risks

In 2002, statistical, technical and economic information obtained on hexane emissions from oil mills helped get reasonable, allowable EPA emission limits and other control requirements for cottonseed oil mills. Also, the potential amendments to the general provisions for emission standards and standard storage and process tanks that could potentially affect oilseed processing were addressed.

The Foundation, along with textile and fiber groups, continued to contribute to the gathering of burn incidence data from Consumer Products Safety Commission in-depth studies. This information has been very useful in helping to retain beneficial amendments to the Children's Sleepwear Flammability Standard and prevent unnecessary new standards. Other data compilations are useful in preventing unnecessary regulations ranging from cotton textile processing and gin and cottonseed oil mill operations to the production of mattresses/bedding and upholstered furniture.

Among 2003 objectives are: 1) working to amend fire/building codes that incorrectly regulate the storage of baled cotton and 2) developing improved flammability treatments and test data for cotton products.

Information obtained on hexane emissions from cottonseed oil mills helped get reasonable, allowable emission limits in the EPA air emissions standard for vegetable oil extraction.

Evaluation of Acetone as an Extraction Solvent for Cottonseed

After 2006, hexane no longer can be used as an extractant for oilseed in California's San Joaquin Valley because the solvent contributes to ozone formation. EPA requires replacement by a non volatile compound, and acetone has environmental regulatory advantages, is safer in the event of a fire and can remove antinutritional compounds such as aflatoxin and gossypol that naturally occur in cottonseed meal.

A pilot oil mill plant was developed at the Texas A&M Food Protein Research and Development Center. A test run done in January 2003 verified its suitability for use with acetone. A series of plant runs in 2003 will further refine the process. Cottonseed industry members interested in contributing to this process advancement were invited to attend the runs and observe analytical tests on products and production samples.

Meeting TMDL Requirements Through Precision Farming

The Institute for Technology Development (ITD) introduced its map-based precision farming technology on 15,000 acres in the Mississippi Delta in 2002 and, through its commercial spin-off company, InTime, on about 75,000 acres there in 2003. The technology has the potential to reduce the application of such inputs as nitrogen and, particularly pesticides, by up to 50 percent. These steps are critical for cotton producers' meeting total maximum daily load (TMDL) requirements levied by the federal government on specific streams and watersheds affected by cotton producers' lands in that region, including the Gulf of Mexico. Among ITD's overall objectives is developing partnerships with Mississippi State University and key federal agencies to accelerate precision technology's adoption.

Use of Particle Size Distributions for Measurement and Modeling of Emissions from Agricultural Operations

Texas A&M University engineers continued to analyze cotton gin dust samples with the aerodynamic particle sizer, the Coulter Counter Multisizer and FRM PM10 and PM2.5 samplers. Their goal is to ensure that all emissions of PM10 and PM2.5 from agricultural sources accurately represent the PM (particulate matter) emissions and that compliance monitoring accurately measures the PM concentration. The faculty at the Center for Agricultural Air Quality Engineering and Science over the past few decades developed a method of accurately determining particulate matter concentrations from industries that emit air pollution. The CCM method of characterizing the size distribution of aerosols has shown that the EPA approved PM10 and PM2.5 samplers over sample agricultural dusts. New methods of determining particulate matter size distributions are continuously sought out for possible use.

Evaluation of FRM PM2.5 Samplers Using the Coulter Counter Multisizer

The Texas A&M researchers also are trying to develop a process that will result in corrections of "over sampling" of PM10 and PM2.5 concentrations of agricultural PM so that agricultural operations are appropriately regulated. The scientists have been able to demonstrate to EPA the errors in sampling agricultural dusts with EPA approved samplers. They are conducting laboratory experiments with PM2.5 samplers to determine their accuracy in the presence of agricultural dusts versus urban dusts. They also believe it is possible they can develop a "characteristic" particle size distribution for grain elevators and for cotton gins.

Dispersion Modeling for Low-Level Point Agricultural Sources

Past research by the Texas A&M engineers has demonstrated that models used by EPA over-predict downwind concentrations of PM10 by up to 10 times when applied to emissions of low-level point agricultural sources (LLAPS) such as cotton gins, feed mills and grain elevators. As part of this ongoing research, a new, more accurate model has been developed that considers short-term changes in wind direction. Using the model requires the standard deviation of wind direction and velocity within each hour. As any states now are keeping those records, further research is being done to modify the model for acceptable regulatory use. The major hurdle to getting more accurate estimates of downwind concentrations from LLAPS is adapting the model to use one hour weather data while still accounting for wind direction variation.

Cyclone Design

Texas A&M University engineers made progress in understanding the cyclone operation – the most efficient gin pollution abatement system. With a goal of engineering the most efficient cyclone, several cyclone models have been examined in this multi-year study, which has revealed useful information about how a cyclone's dimensions affect its performance. For example, the scientists recently have been able to study the particle collection mechanism in the cyclone's outer vortex as a way to understand the relationship between the cyclone performance characteristics and the design parameters.

SPECIAL PROJECTS

Special projects are funded by Foundation members over and above their regular dues. Grant amounts listed for the special projects are per-year amounts. Some projects have been funded for a specific length of time while others are ongoing.

Cotton Leadership Program

DuPont Crop Protection Grant:
$115,000

The Cotton Leadership Program seeks to identify potential industry leaders and provide them with developmental training. A class comprised of four cotton producers and one member from each of the other six industry segments participates in five, week-long sessions. These provide: policy and issue discussions with current and former industry leaders; observation of production and processing and key research across the Cotton Belt; visits with lawmakers and government and regulatory officials; attendance at the National Cotton Council (NCC) annual and mid-year meetings; and communications training.

The 2002-03 class was the Program's 20th which means 200 men and women now have been equipped with training and provided experiences that help them better face the challenges of leadership they assume in state, regional and national interest organizations. That includes 1984-85 graduate Bobby Greene who currently serves as the NCC's chairman - the organization's top post. He is the first leadership class graduate elected to that position, but others have served in key NCC positions including 1983-84 graduate Bobby Carson who currently is serving as president of the NCC's export promotions arm, Cotton Council International. Carson also has served as Cotton Foundation president.

The leadership program has a new web site: http://leadership.cotton.org that provides description, application forms and other useful information.

The NCC's Cotton Leadership Program marked its 20th anniversary with the selection of the 2002-2003 class: front row (l-r) Brian Vanderlick, producer, Alexandria, LA; Tim Detamore, crusher, Oklahoma City, OK; Dan Sullivan, warehouseman, Fresno, CA; Scott Stockton, cooperative, Lubbock, TX; Vern Tyson, Jr., manufacturer, Winston, Salem, NC; and back row (l-r) Jack Seiler, producer, Blythe, CA; George LaCour, Jr., producer, Morganza, LA; Russ Kuhnhenn, ginner, Buckeye, AZ; Edward Clarke, merchant, Columbia, SC; and Todd Isbell, producer, Muscle

Shoals, AL.

Congressional Staff Education/Orientation Program
Monsanto Grant: $110,000

House, Senate and committee staffers get to see U.S. cotton's production and processing infrastructure by visiting farms, gins and other facilities across the Cotton Belt. The orientation's overall aim is to raise urban lawmakers' awareness of an efficient U.S. cotton sector and its contributions to this nation. Another message conveyed during the tours is the U.S. cotton industry's need to compete profitably in the global marketplace.

In August 2003, a group of Washington, DC-based Congressional staffers toured industry operations in the Mid-South and visited the NCC's and Cotton Incorporated headquarters. Another Congressional group saw industry operations in West Texas and Arizona. During their tours, both groups also: 1) were shown public and private cotton research and adoption of leading edge technology and 2) visited with key industry leadership to gain valuable insights on concerns threatening U.S. cotton's health.

Cotton Counts
Bayer CropScience Grant: $100,000

Improving consumers' understanding of U.S. cotton and the industry's economic contributions is the goal of this NCC educational campaign. With a particular focus on students, the campaign is targeting the growing number of Americans who reside in urban centers and have lost their direct ties to production agriculture. Armed with facts such as U.S. cotton's value-added retail impact of $120 billion to the U.S. economy, National Cotton Women's Committee volunteers are carrying cotton's message from the schoolhouse to the state fair. They also helped secure several applicants for the Cotton Town U.S.A. community improvement grants and the new Cotton Counts Scholarships.

Updates on NCWC members' activities and other campaign news and information can be found at www.cottoncounts.net.

The National Cotton Women's Committee put on a Cotton Counts-

themed fashion show at the 2003 Beltwide Cotton Conferences.

Producer Information Exchange (P.I.E.)
FMC Corporation Grant: $95,000

Nearly 700 cotton producers have benefited from this program – one that encourages its participants to maximize production efficiency and speed the adoption of proven technology and farming practices. During four tours, producers travel to one of the four specific Cotton Belt production regions to get face-to-face interaction with their peers and observe production techniques and technology in regions different from their own. Participants also are able to share information with each other on the week-long tours. This enables them to get new ideas and perspectives in such areas as land preparation, variety selection, planting, tillage, fertilization, pest control, irrigation and harvesting. All P.I.E. alumni are encouraged to attend the annual Beltwide Cotton Conferences as a way to learn more about innovative production methods.

California cotton producer Mark Borba described the state's water delivery dilemma when Mid-South producers visited the San Joaquin Valley as part of the 2002 Producer Information Exchange.

Cotton Council International (CCI) COTTON USA Advantage Program
Stoneville Pedigreed Seed Company Grant: $75,000

The Cotton USA Advantage Program supports CCI's overarching effort to increase demand for U.S. cotton fiber and cotton products – a vital endeavor as the U.S. cotton industry's profitability hinges on increased exports. This program enables CCI to leverage funds from USDA through the Market Access Program and from other global partners to carry out retail promotion, advertising and trade servicing activities under CCI's supply-push/demand-pull strategy. Included is the "Cotton Gold Alliance" program in which CCI is partnering with Cotton Incorporated to stimulate demand for U.S. cotton and cotton products in countries where traditionally healthy manufacturer and consumer cotton consumption has been blunted by man-made fibers.

Uniform Harvest Aid Performance Evaluation
DuPont, FMC, Nichino America, Uniroyal, Valent Grant: $75,000

Researchers continue to evaluate standard defoliation and desiccation treatments and newer practices and products. The goal is to use findings to develop effective, contemporary harvest aid recommendations that contribute to harvest efficiency. The scientists' initial findings were included in The Cotton Foundation Cotton Reference Book - *COTTON HARVEST MANAGEMENT: Use and Influence of Harvest Aids.* All of the reference books can be purchased by visiting www.cotton.org/foundation/ref-books.cfm.

Policy Education Program
Syngenta Crop Protection Grant: $60,000

Since this orientation program was initiated five years ago, some 70 NCC producer members have been given the opportunity to learn more about the NCC's policy development and implementation process. As a result, many of those participants are involved in U.S. cotton's central organization today.

Up to four producers from each major Cotton Belt region are chosen to attend the NCC's annual meeting, see the NCC's Washington, DC, operations and meet with key lawmakers.

2003 Policy Education Program participants received training and briefings during visits to Syngenta headquarters in Greensboro, NC, and to Washington, DC. Participating producers included front row from left: Dale Murden, David Sanders, Ben Guthrie, Jeff Camp, Nick McMichen and Lewis Everett; back row from left: Neil Strong (Syngenta), Steven Ford, Milton Parrish, Toby Robertson, Rob Fleming, Brian Muller, John Gibson (NCC) and Jerry Stuckey.

Cotton Nematode Research and Education Program
Bayer CropScience Grant: $50,000

Cotton Belt nematologists and plant pathologists meet annually to discuss their research and report on their nematode population surveys by species and county. New protocols were enacted to ensure uniformity of research. The aim is to address Beltwide nematode losses, which were estimated at 950,610 bales and valued at $345 million in 2002, up 3.5 percent from 2001.

Nematode and seedling disease interaction was covered in a special Seedling Disease workshop in the 2003 Beltwide Cotton Production Conference. Information on nematodes, their distribution and control methods also can be found in the updated booklet, "Cotton Nematodes: Your Hidden Enemies" and at

www.cotton.org/cf/nematodes/index.cfm.

A new logo was developed for the Cotton Nematode Research and Education Program.

Cotton Seedling Disease Research and Education Program

Bayer CropScience Grant: $50,000

This program helps determine seedling disease losses, which in 2002 were 721,384 bales valued at $281.3 million. Seedling diseases also caused an estimated 25-40 percent of cotton acreage to be replanted that year. The program also helps identify the basic disease spectrum in each locale and offers fungicide use and application methods in each state.

More information is available to producers, consultants and others through the brochure, "Know Your Seedling Diseases," and at www.cotton.org/cf/seedlings/index.cfm.

The NCC also conducted a special Seedling Disease workshop in the 2003 Beltwide Cotton Production Conference that provided valuable information on topics ranging from black root rot prevalence to breeding resistance to seedling disease.

Journal of Cotton Science (JCS)

Bayer CropScience Grant: $25,000

This on-line journal, published quarterly at http://journal.cotton.org has evolved into a premier database for multidisciplinary cotton research, and includes an interpretive summary that explains the research's value in layman's terms. Editors in such fields as engineering, plant pathology, molecular biology and weed science help in the double-blind review of all submitted manuscripts.

Volumes from 1997 to date are archived on CD and the JCS was the first all-electronic journal to be indexed in AGRICOLA, the database of the National Agricultural Library.

Technology Transfer through News Media

Monsanto Grant: $18,000

This program provides journalists' with a well-equipped newsroom to enhance their information gathering and dissemination at the annual NCC-coordinated Beltwide Cotton Conferences. The 60-plus contingent of writers and broadcasters who cover this forum help transfer needed information to industry members ahead of the Conferences' proceedings. Rapid adoption of proven technology and cultural practices is critical for U.S. cotton

producers to maintain optimum efficiency.

Writers and broadcasters at the Beltwide Cotton Conferences enjoy a fully-equipped newsroom that helps them with their event coverage and promotes timelier technology transfer.

Beltwide Cotton Conferences Internet Quickstop

Syngenta Crop Protection Grant: $7,750

Strategically placed kiosks at the Beltwide Cotton Conferences contain computers that provide Internet access. This enables conferees to check their email and browse the World Wide Web.

Several special projects support the NCC-coordinated Beltwide Cotton Conferences, including one that underwrites its Internet Quickstop.

Funding For The Future

Vance Publications Grant: Varies

The National Cotton Women's Committee gained additional resources for carrying out the NCC's Cotton Counts consumer awareness campaign. With the $6,000 raised at *Cotton Farming* magazine's Benefit Auction at the 2003 Beltwide Cotton Conferences, this event now has contributed $33,000 over the past four years to the Foundation.

Miscellaneous Projects

Several special projects are still making contributions to the U.S. cotton industry even though their annual grants have ceased.

The Foundation continues to distribute volumes in its Cotton Foundation Reference Book Series, which now can be ordered online. NCC also periodically disseminates Worker Protection Standard Education newsletters and information sheets on topics ranging from product labels to recordkeeping. A special project also made possible the creation of World of Cotton, a permanent area on the NCC home page, www.cotton.org. The site garners public recognition for the industry's economic contributions to the nation.

A number of other Foundation activities are considered special projects and supported by specific member firms. In the Chemical Evaluation Project, for example, USDA Agricultural Research Service scientists at the Southern Insect Management Lab in Stoneville, MS, are analyzing insecticides and application methods with the goal of helping producers lower their insect control costs.

Some other efforts helpful to cotton's overall research and education effort include: the artificial rearing of southern crop insects and the cotton insect rearing and distribution programs; the ginning lab fiber analysis and the periodic development and distribution of various NCC-produced educational videotapes.