

2005-2006 ANNUAL REPORT OF INSTITUTION PROGRESS  
DEPARTMENT OF CROP AND SOIL SCIENCES

**I. Major Accomplishments of 2005-2006:** A complete listing of the impact statements for the department can be found on the Web (<http://apps.caes.uga.edu/impact/>). The accomplishments are discussed according to the issues included in the department's strategic plan of 2000.

**Issue 1. Communication to Fit Clientele Needs.**

Hispanics make up about 50 percent of the 65,000 Green Industry labor force. As this population continues to grow, there is a powerful desire for many Hispanics working in the green industry to improve themselves educationally in this field. An existing distance learning certification program in turfgrass management, developed by UGA crop and soil scientists, was translated into Spanish this year. The course consists of 14 chapters which covers all aspects of turfgrass management, including a chapter on customer relations. There are review questions for each chapter and four self tests. The person must pass two monitored exams with a score of 70 percent or higher to receive certification. The program will be marketed this coming year throughout Georgia as well as the rest of the country and even select Spanish speaking markets throughout the world.

Cotton producers need access to pertinent and up-to-date information relative to their growing region. The UGA Cotton Web Page is used to address this issue by providing timely information throughout the growing season. From this web page, growers can access Official Variety Trial data, the monthly newsletter Georgia Cotton, the Cotton Production Guide, the Georgia Cotton Pest Management Newsletter, Southern Cotton Growers Marketing News, and the Cotton Research and Extension Report. This web page also serves as a UGA Cotton bulletin board where timely information on marketing and upcoming meetings and trainings are posted. Developing issues such as glyphosate resistant palmer amaranth are also detailed in the Breaking News section. The UGA cotton web is visited about 650 times per month by university personnel, industry representatives and growers.

In the fall of 2004, Asiatic Soybean Rust was documented for the first time in the United States. In other soybean growing countries, soybean rust can have a devastating effect on yields if not treated in a timely fashion. A crop and soil scientist in Statesboro established a series of Asentinel plots across Georgia in 2005. These plots consisted of early planted, early maturing soybeans or alternative hosts for soybean rust which were scouted at least once a week for the presence of soybean rust. Sentinel plots were used to document the spread of this disease throughout the growing season, and served as a basis for fungicide application recommendations. These plots were also part of a nationwide effort coordinated by the USDA where detection could be documented on a web site accessible by all interested parties. The spread of soybean rust was successfully documented in Georgia in 2005. Due to the presence of the disease and favorable environmental conditions, recommendations were made to Georgia soybean producers to make at least one fungicide application for the control of this disease. To date, yield limiting infestations of soybean rust on commercial fields have not been documented, despite the

documentation of severe soybean rust infestations in several of the sentinel plots.

The Georgia Golf Course Superintendents Association and the Georgia Department of Natural Resources – Environmental Protection Division entered into an agreement in which water restriction language within the outdoor water use guidelines on golf courses may be eliminated providing 75 percent of the GGCSA member courses develop site-specific Best Management Practices by May 2007. UGA turf grass scientists have been integral in providing information to both GGCSA and DNR-EPD on the positive aspects of implementing the BMPs approach to water conservation, as opposed to rigid regulations. Additionally, the scientists have lead the educational efforts on developing and writing BMPs to meet the DNR-EPD's deadline. During 2005, scientist conducted full-day workshops for more than 150 golf course superintendents and assistant superintendents. This is an innovative approach to encouraging water conservation in which a state regulatory agency is allowing an industry to develop its own water management guidelines that are based on sound science. This could only occur through communication and collaboration among regulatory agencies, industry and scientists. Adoption of a BMPs approach has the potential to transcend the golf courses and move into other segments of the turf grass industry, further improving water conservation. BMPs are the best means to address water conservation on a long-term, sustainable basis.

To meet the requests of county Extension agents, turf grass professionals and the general public, [www.GeorgiaTurf.com](http://www.GeorgiaTurf.com) was restructured to provide a one-stop source for information on Georgia's turf grass species, management, fertility, pest control, impact of the turf grass industry on Georgia's economy and upcoming educational events. [www.GeorgiaTurf.com](http://www.GeorgiaTurf.com) has become a more visual site, incorporating pictures and graphics, providing information, making direct links to electronic versions of extension publications, broadening its portal range, highlighting new postings, and providing an outlet for posting of results from research trials and the Annual Turfgrass Pest Control Recommendations for Professionals. The site is more dynamic, being updated continuously, easier for turf grass faculty to make postings and disseminate information, and allows for ease of future revisions. Prior the launch of the updated version, the site was being accessed less than 3,000 times per month. Activity has remained high averaging greater than 73,500 hits per month with April 2005 having the greatest activity with 140,324 hits.

## **Issue 2. Clientele Competitiveness and Profitability.**

Georgia growers looking for alternatives for summer crop production behind onions, winter grains, vegetables and watermelons have had trouble finding profitable crops to grow that would fit into yearly rotations. Corn has been a poor alternative in recent years due to the lack of disease and insect resistance in temperate hybrids. UGA crop and soil scientists conducted studies to compare current temperate corn hybrids with adapted tropical hybrids and other grains, including pearl millet and grain sorghum, to find out if any grain crop would be suitable for production under late season conditions. The four year study revealed disease resistant temperate hybrids planted up to late May outperformed the tropical hybrids by 25 bushels per acre. However, if the temperate hybrids were susceptible to southern leaf blight and/or southern leaf rust, then the tropical hybrids were significantly better. In all cases, the BT versions (insect

resistant) of each hybrid out-yielded the non-bt type by 12 bushels per acre. In very late planted conditions, tropical hybrids out-performed the disease resistant temperates by nearly 50 bushels per acre. Three times more grain was harvested in tropical hybrids than grain sorghum or pearl millet. Today, depending on when the corn is double-cropped, corn can successfully be used as an alternative to other crops in late planted conditions.

Because of the success of the Boll Weevil Eradication Program, favorable market prices over and above U.S. farm commodity programs, and the general suitability of the crop in the state after successful eradication of the boll weevil, cotton acreage in Georgia exploded to a modern-era high of 1.5 million acres. Over the past nine years, the adoption of genetically engineered varieties with genes conferring pest management traits has revolutionized cotton production in Georgia. Transgenic varieties have been planted on more than 90 percent of the acreage each year since 2000. Unfortunately, during these same years, Georgia has experienced a significant decline in reputation of the fiber quality of cotton produced in the state. UGA scientists have invested considerable resources towards the issue of cotton fiber quality. Several Cotton Team members work with other scientists throughout the country to consider the nature and scope of the problem and possible solutions. The UGA Cotton Team and its partners determined that increased short fiber content is the probable source of reduced spinning efficiency associated with cotton from Georgia. Georgia cotton typically averages a full point below cotton produced in the MidSouth. The message has been delivered to producers and others through a variety of media and means. Georgia producers and ginners are now well aware that quality is an issue of intense importance. Research and demonstration efforts have identified the effects of stink bug injury on almost every measure of fiber quality. Growers in 2004 and 2005 were much more aggressive in controlling stinkbugs than in previous years, and field assessments indicate considerably less damage in 2004 and 2005 than in 2003. Overall quality of the 2004 crop and 2005 crop (early reports) is superior to that of the 2003 crop. The spotlight on fiber quality has caused gin managers to scrutinize and improve their handling/processing systems and to encourage growers to do likewise. In the gin community, the quality message has been heard.

Corn producers look to improve production efficiency and yields as costs continue to rise and commodity prices fall. A UGA crop and soil scientist investigated the impact of row width on corn yields to determine if producers could justify changing to benefit either yield or production efficiency. Producers looking to have a positive change in row crop production in Georgia can shift to narrow row production in corn with confidence. A five-year study completed in 2005 demonstrated that narrow row spacing (20 inch rows) outperforms wider 36-inch row spacing by an average of 20 bushels per acre. This same study over the past two years has also shown 20-inch row corn out-yields twin row and 30-inch row corn. Given the average corn receipts of the past four years, this would represent an additional revenue gain of \$50 per acre.

Aflatoxin is a mycotoxin that is produced when toxic strains of the fungus, *Aspergillus flavus*, invade and feed on crops such as corn, peanuts, tree nuts and cotton seed. In Georgia, this carcinogen can be a serious problem in corn when the crop is stressed during grain development and after harvest in storage. UGA crop and soil scientists began work three years ago on a biological approach to reducing or eliminating aflatoxin in corn. A non-toxigenic strain of

*Aspergillus flavus* found by USDA-ARS has been successfully studied in peanuts and is currently being used on some Georgia farms. In peanuts, a reduction in aflatoxin occurs when the non-toxic strain is applied directly to the field on a carrier like barley seed. This strain then grows when conditions are right for sporulation and out-performs the native toxic strain, competing for food sources and reducing the toxic strain invasion of peanuts. Two years of studies were conducted in Georgia on corn at several locations where aflatoxin has been a continuous problem. Unfortunately, the results were disappointing and unlike results in other states. When the non-toxic strains were applied to fields under corn production, the strains failed to grow in sufficient quantity to compete with indigenous strains. However, when corn was grown in fields where the non-toxic strains had been previously applied in peanuts, aflatoxin levels were lower than the control. This study demonstrated that there is potential to follow peanuts with corn where the non-toxic strains have been applied and successfully established and expect some reduction in aflatoxin levels in corn.

The soybean breeding and genetics program at UGA aims to develop improved soybean cultivars for Georgia and the Southeast, while providing opportunities for graduate and undergraduate students to get training and experience in both molecular and conventional plant breeding. A strong emphasis on using molecular markers to genetically map useful genes and transfer them to elite germplasm has made the UGA program a model for the successful integration of conventional and molecular breeding approaches in a public breeding program. Some of the current studies in the program involve identification and exploitation of genes that increase yield, drought tolerance and resistance to diseases, nematodes and insects. The availability of resistant cultivars reduces pesticide use, and therefore has environmental benefits, as well as reducing the cost of soybean production. Efforts to improve seed quality traits have nutritional and environmental benefits, while helping to keep Georgia-grown soybeans competitive in both national and international markets. All of these projects are likely to benefit Georgia soybean breeders, while giving students and post-docs valuable experience in various aspects of contemporary plant breeding methods. The program has been successful largely due to the efficient integration of conventional and molecular breeding approaches.

The development of resistant small grain cultivars to the two new disease problems (stripe rust and wheat soil-borne mosaic virus) in Georgia and Southeast will significantly prevent yield and economic losses as well as protect the environment by reducing the amount of fungicides or insecticides used. The UGA Small Grain Breeding Team is working to develop improved cultivars to stripe rust and wheat soil-borne mosaic virus. Increasing yields and improving disease and insect resistance, and improving milling and the baking quality of small grains will help to insure small grains economic viability. New resistant genes for leaf rust, powdery mildew and Hessian fly are also being crossed to adapted cultivars, and selected for resistance to combat the new races of pathogens and insects. The UGA Small Grain Breeding Team regional program has resulted in the release of broadly adapted cultivars. In 2005, two new high yielding wheat cultivar, GA 951079-2E31 and GA 951216-2E26, were exclusively released to private companies. These two wheat releases are high yielding cultivars with excellent test weight and disease and insect resistance and will offer new source of resistance to both pathogens and

insects. These two cultivars will provide excellent resistance to two new pests in Georgia, stripe rust and wheat soil-borne mosaic virus.

In the southeastern United States weed control in soybean fields requires significant managerial and monetary input by the grower. Glyphosate (active ingredient in Roundup® herbicide) is a broad-spectrum herbicide. The development of a glyphosate-tolerant soybean (Roundup Ready®) by the Monsanto Company provided the opportunity to breed elite varieties that were insensitive to the application of herbicidal rates of glyphosate. Since cost-effective weed control is an important consideration for southeastern soybean growers, UGA crop and soil scientists initiated a backcross breeding program to introduce glyphosate tolerance into the previously developed UGA soybean varieties Benning, Haskell, Boggs, and Prichard. The application of DNA marker selection hastened the recovery of the yield and pest resistances of these adapted soybean varieties. Two additional years of field testing identified Roundup Ready® versions of Benning, Haskell, Boggs, G93-1749, and Prichard. These four newly developed Roundup Ready® varieties were equal to their non-Roundup Ready® parent in seed yield, seed composition and disease resistance. The University of Georgia Research Foundation in collaboration with the Georgia Seed Development Commission licensed the marketing rights of these Roundup Ready® varieties to AgSouth Genetics (ASG Prichard RR, ASG 758RR, and ASG Boggs RR), UniSouth Genetics (USG 7732nRR), and Monsanto Company (H 7242RR). In 2005 these varieties were planted in more than 80 percent of Georgia's soybean fields.

Turf grass soils high in sand content often show varying degrees of water repellency. Such soils will remain dry even after irrigation. UGA crop and soil scientists conducted a field study to determine if the use of a wetting agent would improve irrigation efficiency. That is, reduce the amount of water necessary to bring soil moisture to an adequate level. Over the past two years, two popular wetting agents were used at manufacturer's rates. The study was conducted on a Pennncross creeping bentgrass green. The results showed that two to three times more water was necessary to bring the soil to a volume water content of 15 to 20 percent when a wetting agent was not used. The findings of this study will allow turf grass managers to save significant amounts of water when irrigating water repellent soils.

### **Issue 3. Natural Resource Management for Sustainability.**

The continued exponential growth in human population has created a corresponding increase in generation of biosolids, end product of wastewater treatment plants. Land application is becoming a major means for biosolids disposal because of its beneficial effects on agricultural productivity of soils. However, due to its close association with human activities, biosolids often serve as a sink for anthropogenic organic chemicals that cannot be degraded during the wastewater treatment processes. In collaboration with a UGA agricultural engineer, a UGA crop and soil scientist investigated the fate of Nonylphenol, an endocrine disruptor, in biosolids compost. Nonylphenol was detected up to 1,000 parts per million in several biosolids from wastewater treatment plants servicing cities with heavy industry. The data suggest that sensitized photolysis reactions may play important roles in degrading NP in surface applied biosolids. The

safest approach to avoid potential detrimental effects of biosolids-associated anthropogenic organic chemicals to the environment is to ensure that the compounds are adequately degraded before biosolids land application.

High numbers of fecal bacteria have triggered advisories for a number of Georgia's beaches. Bacterial source tracking identifies the sources of fecal bacteria using a variety of microbiological and chemical methods. UGA crop and soil scientists conducted a targeted sampling with three BST methods of the beach on St. Simons Island. Although fecal contamination was not a concern in the surf zone, almost all the storm drains and Postell Creek, a tidal creek located near the beach, had excessive fecal contamination. One of the storm drains was confirmed positive for human fecal contamination, but the results for the rest of the sampling sites were confounded by the presence of high amounts of organic matter, which gave false high fluorometric readings. The scientists solved this problem of false readings and will sample the beach again following a storm. They believe targeted sampling combined with a number of simple BST methods may offer an inexpensive way to identify sources of fecal contamination in Georgia's waters.

Global warming and climate change associated with greenhouse effect are of major concern for all living organisms on the earth. Due to industrial and vehicular emissions, concentration of carbon dioxide (CO<sub>2</sub>) in the earth's atmosphere is increasing, which is the major cause for global warming. Vegetation absorbs CO<sub>2</sub> during photosynthesis and helps to reduce CO<sub>2</sub> in the atmosphere. In this respect, the role played by forest and agricultural ecosystems in delaying or reducing the effects of global warming is of utmost importance. One important component of a UGA program in crop and soil science formulates methodologies for reducing errors in the estimation of ecosystem carbon balance. Micrometeorological and CO<sub>2</sub> flux measurements are conducted at a managed 14-year old slash pine plantation located at Gainesville, Florida. In collaboration with scientists from other universities and national laboratories, several intensive measurement campaigns are conducted with the help of slow and fast response micrometeorological instruments, infrared CO<sub>2</sub> gas analyzers and acoustic remote sensing equipments. Results indicate that low-level jets generate large turbulence and mixing within and above the forest canopy. The measured ecosystem CO<sub>2</sub> respiration is found to be much higher in presence of low-level jets, when compared to other days with calm atmospheric conditions. The second aspect of the research, aimed at developing a micrometeorological tool for detection of environmental stress on peanut crop, is carried out at a peanut field near Vienna, Georgia. The measurements include CO<sub>2</sub> respiration, latent heat flux, net radiation, atmospheric stability, air and soil temperature, soil water content and other weather parameters. Preliminary results indicate that nighttime respiration rates are generally high for the days corresponding to low soil water availability than those corresponding to wet soil. The study is expected to help develop a decision making tool for irrigation management.

Plants, animals and microbes pose serious threats to natural resources and account for billions of dollars in economic damage annually. Reports of earthworm invasions throughout the world indicate that at least 100 species have achieved distributions beyond their places of origin. As

observed for exotic plants, fungi and insects, increasing global commerce may be increasing the spread of exotic earthworms, both inadvertently with the importation of soil-containing materials and intentionally for use in commercial applications. Because previous invasions by exotic earthworms have had significant impacts on soil processes and plant communities, there may be reason for concern over continuing, unrestricted spread of earthworms. Additionally, the recent outbreak of foot-and-mouth disease in Europe has heightened concern about earthworm importation because some species may be vectors for that and other pathogens. The USDA Animal and Plant Health Inspection Service (APHIS) is now considering guidelines specifically for the importation of earthworms into the United States. A UGA crop and soil scientist acquired funding for a field research project and a workshop to assess this problem.

Onsite wastewater management systems are a cost effective and environmentally benign method to manage household wastewater if properly installed on suitable soils. Most soils have a large capacity to remove or immobilize bacteria, viruses, nitrate, phosphorus, and other potential ground and surface contaminants. There is concern, however, that high amounts of nitrogen and phosphorus added to the soil over the life of a typical onsite system may exceed the soil's capacity to assimilate these wastewater components. UGA crop and soil scientists decided to evaluate the applicability of electromagnetic induction (EM) techniques for detecting lateral movement of wastewater away from onsite system drainfield trenches. Ground conductivity as measured by EM had only limited success in detection of lateral wastewater movement away from drainfield trenches. Over most of the area of the drainfield at the three sites evaluated, neither the drainfield trenches nor any lateral wastewater movement away from the trenches was indicated by ground conductivity surveys. The EM technique may be applicable at sites where appreciable lateral wastewater movement has occurred, but because the drainfield trenches that contained wastewater were not detected, the technique does not appear to be sensitive enough to detect the low concentrations of nitrogen and phosphorus added to the soil from onsite systems.

Each year, the poultry industry in Georgia generates about 2 million tons of broiler litter, most of which is surface applied to grasslands as fertilizer. Surface application of broiler litter to grasslands is of concern because it can contaminate surface runoff with phosphorus, which can potentially accelerate eutrophication of surface waters. UGA crop and soil scientists conducted rainfall simulation studies. They compared the effectiveness of three mechanical aeration treatments -- disking perpendicular to the slope, aeration by spikes, and aeration by cylindrical cores -- in reducing the loss of phosphorus in surface runoff from grassed plots on Cecil soil that were fertilized with broiler litter. Results showed that core aeration reduced losses of inorganic phosphorus in surface runoff by 62 percent, and reduced losses of total phosphorus in surface runoff by 46 percent. Because Cecil soil is common in grasslands receiving broiler litter in Georgia, these results suggest that the use of core aeration could have a significant impact on water quality in the Southern Piedmont region.

Efforts to improve water quality in streams and lakes has focused on the contribution from non-point sources of pollution such as agriculture, silviculture, and urban land use. These efforts include the federal Total Maximum Daily Load (TMDL) program which requires that streams be

monitored to determine if they meet state water quality standards. Complex watershed-scale computer models are used to develop estimates of the pollutant loads from different sources in these streams and to predict the effect of various landuse changes and implementation of best management practices in reducing pollutant loads to an acceptable level. UGA crop and soil scientists wanted to develop a method for setting confidence limits on predictions of stream water flow using a commonly used watershed-scale model called the Soil and Water Assessment Tool (SWAT). They developed a two-stage method that finds the optimum set of more than 40 parameter values and then sets confidence limits without excessive computer run times. The Parameter Estimator (PEST) software was used to conduct the two-stage automatic calibration and prediction uncertainty analysis. The prediction uncertainty analysis worked well for long-term (annual) flow in that the prediction confidence intervals included or were very near to the observed flow for most years.

#### **Issue 4. Development, Evaluation, and Delivery of Technologies.**

Turf grass managers are increasingly confronted with development of site-specific water conservation practices -- and this will be the No. 1 problem confronting the turf industry in the future. However, an in-depth, science-based, holistic-systems Best Management Practices (BMPs) approach has not been well defined for turfgrass water-use efficiency/conservation. An overall plan was developed by the UGA Crop and Soil Science Department in Griffin to foster adoption of a BMPs approach for turfgrass water-use efficiency and conservation that would have state, national and international impact in this critical area. The scientists completed a detailed document on "BMPs for Turfgrass Water Conservation" booklet with revision in 2005 and posting on a web-site for public use. The document includes a planning process to develop and implement a site-specific BMPs program on a golf course; information on all strategies; options within each strategy; and a template for what a BMPs document should contain. In 2004, turf groups using this information initiated discussions in Georgia and Arizona with their state Department of Natural Resources to allow a BMP approach to water management rather than a rigid regulation approach. The team has presented workshops nationally and internationally on the plan. They are completing two books on the topic and the information is being integrated into classes for turf majors as a model for future programs.

Reducing the dependance of chemical insecticides needed for crop production helps long-term economic and ecological sustainability of crop production. Insect resistance can be incorporated into the crop itself, using either genetic engineering or more conventional approaches. The key is that the final crop must be effective across of a broad spectrum of defoliating insects and be sustainable. That is, the insects must not overcome this resistance as easily as they have overcome many of the chemical insecticides. Accordingly, UGA crop and soil scientists set out to identify various genes in wild soybeans that could be used for the purpose. At this point, they have found several genes in wild soybeans that confer resistance to insects, tested them in various combinations, including with engineered genes, and have found combinations that give the desired results in a breeding program. Substantial progress has been made towards cloning one of these genes from wild soybeans. This will make it easier to understand how the gene

works and use it more effectively in future breeding attempts.

In November of 1999, Georgia's Environmental Protection Division suspended issuance of Agricultural Water Withdrawal Permits in southwest Georgia. The permits, required before farmers can take water from streams or aquifers in Georgia, are mostly used for irrigation. Fearing an overdraft of the region's water, EPD froze more than 1,500 applications on hand and stopped accepting new applications for withdrawals from the Floridian aquifer under the Dougherty Plain or from streams in the Flint River Basin. EPD initiated a River Basin Water Development and Conservation Planning process, seeking an assessment of the flow behavior of area streams and rivers and water tables in the predominant aquifer during drought seasons. UGA agricultural engineers and Cooperative Extension specialists teamed up with 680 Georgia farmers who volunteered to allow UGA personnel to visit their fields and record irrigation. Traveling more than 500,000 miles to make almost 40,000 field visits to 860 fields, team members accumulated an accurate picture of agricultural water use in wet years as well as during the most severe drought in half a century. To get an accurate measure of the area and location of irrigation and the location of surface and groundwater withdrawals, college specialists developed a GIS-based permit management system for EPD and worked with permit holders in southwest Georgia mapping their irrigation systems. Scientists assimilated the data for USGS and EPD modelers who were predicting the behavior of the watershed to irrigation and other water uses. Typical and drought-year irrigation scenarios were developed for each month, each water source, and each sub-basin, taking into account the regional mix of crops already in place. A draft study and action plan has been completed. The plan represents the State's most ambitious plan for water management affecting a largely agricultural area. The data and tools provide area farmers and state water planners a rationale for water management for a sustainable agricultural economy.

Methyl bromide is the primary means of managing many pests in vegetables, including weeds, nematodes, soil-borne pathogens and insects. Georgia's most troublesome weed infesting vegetables, nutsedge, is the most difficult pest to manage in the absence of methyl bromide. As methyl bromide production was expected to cease in 2004, the Georgia Fruit and Vegetable Growers Association submitted six Critical Use Exemption packages, prepared by the University of Georgia Vegetable Team, to the United Nations to request an extension for use of methyl bromide vegetable production beyond 2004. In the meantime, UGA crop and soil scientists conducted more than 100 acres of replicated field trails on research and growers' farms across Georgia during 2005, searching for methyl bromide alternatives. Research efforts focused on finding effective and economical alternatives to methyl bromide using various fumigants and mulches, and finding ways to reduce the rate of methyl bromide needed to manage weeds. Research showed methyl bromide alternatives do not currently exist for managing weeds in vegetables produced on plasticulture. Data generated from this work is the primary source of data supporting Georgia's CUE packages, which were successful for 2006 allowing our growers to purchase methyl bromide in 2006. The estimated value of these CUE packages exceeds \$50 million per year for Georgia. Although the research results did not discover alternatives that could be immediately adopted by growers, results offer the possibility for several of these

alternatives to be adopted by growers between 2008 and 2010.

One of the ways that peanut growers prefer to reduce inputs is through combining pesticide applications such as herbicides and fungicides. From 2002 to 2005, UGA crop and soil scientists conducted field trials to evaluate the effectiveness of several herbicide/fungicide combinations. Results of these tests, in combination with research from other states, has resulted in the development of a regional publication entitled “Tank-mixing Chemicals Applied to Peanut Crops: Are the chemicals compatible?” This publication is maintained at North Carolina State University and is available on-line. In 2005, if only one pesticide application was reduced from tank-mixing a herbicide with a fungicide, peanut farmers in Georgia would have saved an estimated \$3 million in production costs.

### **Issue 5. Recruit, Retain, and Educate Students to Meet the Present and future Needs of Clients in a Rapidly Changing World.**

The advent of globalization has meant university students must be aware of and competitive in a global economy. The environment, ecology, culture and cropping systems of tropical countries are so far outside the range of experiences that Georgia students encounter, it is difficult for students to conceptualize the issues involved. In such cases, there is no substitute for actual experience. UGA crop and soil scientists established the Costa Rica Study Abroad course, which gives students first-hand experience with a different part of the world, while addressing the various factors that contribute to sustainable development. This Study Abroad program is the longest-running program within CAES, and trains a new group of students every year.

## **II. Progress in Strategic Planning.**

As a follow-up to the 2000 Strategic Plan (Appendix\_\_\_) the Department of Crop and Soil Sciences developed a set of “major issues” (Appendix\_\_\_) in 2003 important to the department: build and maintain a strong department, conduct annual faculty retreats, continue to build on a key departmental strength (i.e., diversity), enhance appreciation of teaching and take advantage of the three locations. Continued efforts in response to comments from the 1999 review and progress on “major issues” will be presented.

### **Efforts made toward “major issues” developed in 2003.**

Build and maintain a strong department- During this year, CRSS continue to strengthen the department by supporting the filling of vacant faculty positions and increasing student enrollment. Although the department budget was decreased from the college assessment, the decline was less than in the previous two years. Because the budget situation was beginning to stabilize, faculty continued to enhance extramural support, and the nonpersonal services budget was sufficient to support programs, the faculty discussed and recommended filling vacant positions (Appendix\_\_\_). Using available departmental funds to fill positions verses providing additional program support was a faculty decision. The faculty felt this approach would be the

best strategy to maintaining a strong department. The first college Georgia Power Professorship was awarded to the CRSS department. Filling this position will strengthen the Environmental Sciences program. The department also hired a Full Professor to fill the forage breeding position. Dr. Charlie Brummer will further strengthen programs in breeding/genetics/genomics. CRSS faculty believe that a vibrant teaching program is essential to a strong department. Increasing state-wide enrollment is a good indicator that students recognize CRSS as a strong department.

Conduct annual faculty retreats - CRSS faculty meet each spring and fall to consider P & T, post tenure review and other issue important to the department. Faculty meet in discipline groups to discuss issues and prioritize program needs. As part of the fall meeting, faculty discuss teaching issues.

Build on a key departmental strength (i.e., diversity) and take advantage of the three locations - Two key strengths of CRSS are the location of the faculty at the Athens, Griffin and Tifton campuses and the interdisciplinary programs. In order to maintain departmental diversity and needed expertise within disciplines and locations, faculty recommended filling critical vacant positions. Each of the three campuses have unique strengths that are critical to the mission of the department. All these factors are considered as part of the departmental decision as to what positions to fill and the responsibilities of positions. Present and future needs are the primary consideration. For example, faculty are now teaching at Tifton and Griffin which adds a new functional responsibility at these locations. Scientific expertise and functional responsibilities were changed if needed for each position to help ensure CRSS remains strong and diverse at each location.

Several special initiatives were supported to help build on key departmental strengths:

- **Soil Test Calibration and Fertility Recommendation Initiative:** A joint initiative to review, verify and improve soil test calibrations and fertility recommendations for major horticultural and agronomic crops with the Department of Horticulture has begun. Dr. Roger Teal will lead these efforts. This initiative is in cooperation with the College of Agriculture and Environmental Sciences Agricultural Environmental Services Laboratories.
- **Web Based Information Delivery:** An outside vendor with expertise in web-based information delivery has been contracted to support the department extension faculty in regular updating and uploading of all publications, power point presentations, and newsletters to individual web pages in order to improve access of information and up-to-date publications by county agents.
- **Formation of Forage Extension Team:** The forage extension program effort will be coordinated through a team approach to more effectively handle statewide responsibilities. Extension faculty and county agents will be team members. The county agents will engaged in-depth forage management training, program planning and

implementation.

- Establish a UGA on-site waste water system education program: This project would provide continuing education for onsite system contractors and regulators. A grant from Georgia Department of Human Resources (DHR) will provide most of the first year of salary for a Public Service Assistant, Dr. Kent McVay, who is responsible for the educational program. Continued funding for this position will be from fees charged with the continuing education sessions.
- A cooperative tobacco program with the University of Florida was established. Dr. J. Michael Moore will coordinate tobacco research and extension programs for Georgia and Florida. Florida will provide funding for this program

Enhance appreciation of teaching - The CRSS department values faculty contributions to teaching. Teaching programs enhance the quality of the department, the lives of students and should be valued so as to enhance the professional development of faculty. Several assessment methods are used to gain student input and assess faculty teaching activities. Results from these and outcomes are discussed with faculty as part of the annual evaluation process. Student input is gathered through course evaluations, the Department Head interviews all graduates and the department conducts an alumni survey. During faculty evaluations, student “feedback” is discussed. The new faculty evaluation form (Appendix\_\_\_) includes a section on teaching. The department has a peer review process (Appendix\_\_\_). This process involves both internal and external review of a faculty’s teaching. The department now supports 5 majors: Water and Soil Resources (Athens), Environmental Chemistry (Athens), Turfgrass Management (Athens), Agri-Science and Environmental Systems (Tifton) and Environmental Resource Science (Griffin). All majors except Turfgrass Management have been developed within the last three years. The effort to create these majors was undertaken to specifically enhance the departmental teaching program and reflects a continuing commitment by the CRSS to appreciate teaching.

Increasing focus has been placed on graduate education. The graduate committee has studied and recommended several changes to the graduate educational process. The graduate committee now has faculty members from all three locations. Faculty are encouraged to more actively participate in graduate education. The department has established several programs/initiatives to support graduate education: the Department Head meets with students to improve communications, a travel fund has been established to encourage students to present their research at professional meetings, graduate students are provided business cards, the Graduate Coordinator hosts an annual orientation and a student poster competition is hosted by the department.

### **Continued efforts to respond to comments from the 1999 review-**

#### Concerning Faculty and Department Operations:

1. *The faculty should undertake a long-range planning process to better define the department’s*

*mission and goals (Appendix\_\_\_). Completed.*

*2. The above planning process should include priorities for filling future faculty vacancies that are developed and supported by the existing faculty. The faculty should also support a statement defining the role and authority of the REI positions (campus coordinator). Faculty re-evaluate recommendations on program priorities (i.e., which positions to fill and programs responsibilities) during the spring and fall faculty meetings. REI responsibilities are explained in the By-Laws (Appendix\_\_\_).*

*3. The department should revise its faculty evaluation system. A new faculty evaluation form was developed through the Executive Committee (See Appendix\_\_\_). The form provides for the assessment of faculty contributions from teaching, research, extension and service. Each activity is “weighted” according to importance. A cumulative score is developed to determine the relative programmatic impact. The annual evaluation process involves discussing the results from the evaluation form, teaching assessment results, needed resources, plans for the next year and professional development.*

*4. The College should allow the department to fill staff vacancies in a timely manner. The department has developed a plan to fund the assessment payment and is filling eight positions (Appendix\_\_\_). Staff positions are filled on a priority basis if funding is available.*

*5. The department should consider converting a technician position into a computer and media support position. The department provided funds to EITS to develop a new web page and continued IT support. The Administrative staff coordinates general web maintenance and “desk top” publishing (e.g., brochures). The department will provide additional funds to EITS for web support when needed. Continuing to allocate funds to support “outsourcing” IT support will become increasingly difficult as the department’s budget continues to decrease.*

#### Concerning Staff

*1. The department should request that the Associate Vice President for Human Resources undertake a classification review of the department’s staff positions. The University implemented a new staff classification system. The new system provides for broader salary ranges within each classification. Salary recommendations are based on supervisor evaluations (Appendix\_\_\_). The department does attempt to address severe salary compression issues if performance is not an issue.*

*2. The department should recognize that staff morale problems noted by the review team and seek avenues to correct this situation. The department recognizes that there is a staff morale problem. Several initiatives have been implemented to help deal with this situation. Staff salaries are usually part of a moral issue. The department tries to ensure that the raise process is understood by the staff and is managed in a consistent manner. Salary compression is addressed on a case by case bases, although each year all staff salaries are reviewed. The Department Head*

meets with administrative and technical staff at all three locations to provide an opportunity for improved communication.

3. *The College should request that periodic training courses be provided by the Staff Development Department on the Griffin and Tifton campuses. All staff have the opportunity to attend training courses or be trained by experienced personnel.*

#### Concerning Instruction

1. *The department should develop a plan to improve both undergraduate and graduate recruitment efforts.* The department has a continuing commitment to increasing enrollment in our undergraduate and graduate programs. A Teaching Committee (academic, undergraduate and graduate coordinators, and department head) was formed that meets routinely to discuss methods to increase enrollment. The department hired a student worker that is dedicated to developing recruiting and marketing material. The department hosts an annual teaching workshop which helps focus our efforts on our teaching program. The academic coordinator has expanded responsibilities which include active recruiting on the Athens campus. Three new courses were developed that are offered on north campus (student learning center) to recruit students into our department. Faculty continue to recruit for our 2 new majors: Water and Soil Resources and Environmental Chemistry. The former is an interdisciplinary major with the School of Forestry and the latter is a collaborative effort with the Department of Chemistry. The undergraduate curriculum and graduate committees have state-wide representation to reflect teaching programs at all three campuses.

The department is committed to expanding our graduate student enrollment. The department's greatest capacity for graduate student growth is at Tifton and Griffin. Each campus now has a representative on the graduate committee. The Graduate Coordinator and Department Head work together to get more faculty involved in graduate education. These efforts have resulted in some increase in faculty at Tifton and Griffin participating in graduate education. We did not reduce our graduate assistantship funding during the recent budget cuts. To keep our student number growing, we also established a system of allocating our assistantship funds on a competitive basis. In addition, most of our assistantships are cost-shared on a 50/50 basis, assistantships were increased in 2005 to be more competitive on a national basis, the department is funding the health insurance fee.

#### Concerning Facilities

1. *The College should install a G-SAMS system or internet conferencing system within the Miller Plant Sciences building to improve communication between campuses.* The department has invested in IP based teleconferencing equipment. The system is now installed and being tested. This system will allow CRSS to easily and conveniently communicate.

2. *The department should renovate the soils teaching lab.* The department has renovated two teaching laboratories, graduate student office space and a plant growth room.

3. *Laboratory and greenhouse space on the Athens campus may require expansion and/or renovation.* The CRSS greenhouse facilities have been improved. Additional funding has been allocated for further improvements to the CRSS greenhouse and farm complexes.

4. *The department should explore the possibility of developing a relationship with the municipal or private owners of an existing golf course, enabling the department to use portions of the course for teaching or research.* The department maintains good relationships with golf courses throughout the state and, if needed, they could be used for research and teaching purposes.

### **III. Progress in Assessing Unit or Area Effectiveness.**

Methods for assessing teaching: See previous section–**II. Progress in Strategic Planning; Enhanced Appreciation of Teaching.**

Graduate education is assessed through course work, the students’s thesis or dissertation, preliminary exam process and an annual report conducted by the Graduate Coordinator (Also see the following section of this report: **Graduate teaching; What evidence can you provide that your students are attaining the program’s learning outcomes and what changes are needed in the program to improve their performance?**). The department has implemented a Graduate Learning Assessment Plan.

Methods for assessing faculty programs: See previous section–**II. Progress in Strategic Planning, Concerning Faculty and Department Operations:** 3. The department should revise its faculty evaluation system.

### **IV. Retention and Graduation.**

Once students enroll with the CRSS department a key focus becomes retention and graduation for both undergraduates and graduate students (also refer to the **Graduate and Undergraduate Program Review** sections of this report). For all students, the process begins with a rigorous admission process. CRSS faculty want all students to be successful so the department maintains high admission standards. Once admitted, all undergraduate students are assigned a faculty advisor. The relationship between the student and the advisor is maintained until graduation. Graduate student advisement is through the major professor and the student’s committee. Students are encouraged to form their committee as soon as possible once they are admitted to the department. Student progress is assessed annually.

The quality of the educational experience is very critical to retention and graduation. The quality of instructors, major professors and courses all influence student interest and enthusiasm which ultimately affect student retention and graduation. The department implemented a new teaching requirement for all PhD students. An annual student orientation is hosted by the department to provide students with an opportunity to better understand what is needed to be successful. The department supports a student travel program and poster competition. Students also serve as

departmental ambassadors and help with recruitment efforts and serve on Search and Screening committees for teaching positions. Graduate students are provided an opportunity to obtain business cards and all students are encouraged to participate in club activities. The department works closely with students clubs. The CRSS faculty continuously evaluate course content to enhance learning. The peer review process and assessment programs also help to ensure a high quality teaching programs. CRSS department faculty have also developed new majors to provide students with curricula that prepare them for an increasingly competitive job market.

## **V. Overall Health of the Unit.**

The CRSS department teaching programs continue to grow. The projected enrollment is now 85 undergraduates and 42 graduate students. Students now have the following educational options: Turfgrass Management, Water and Soil Resources and Environmental Chemistry; a Plant Science Area of Emphasis in Applied Biotechnology and Biological Sciences; and a minor in Crop Sciences, Turfgrass Management, and Environmental Soil Science. CRSS offers a Master of Science degree in Agronomy and a Doctor of Philosophy degree in Agronomy. CRSS also offers a non-thesis Master of Crop and Soil Sciences degree and participates in an interdepartmental Master of Plant Protection and Pest Management degree. In addition to the aforementioned majors offered at the Athens campus, Crop and Soil Sciences faculty teach courses at the Tifton and Griffin campuses that support the department's Agni-Sciences and Environmental Systems, and Environmental Resource Science majors, respectively.

The state budget situation has started to improve. The department state budget is \$5.8 million. Faculty continued to enhance program support through extramural funding: \$4.6 million in competitive grants and \$800,000 in non-competitive support. Program impact continued to be effective even with the loss of several key faculty members. Existing faculty assumed critical teaching, research and extension responsibilities. The department is now moving forward to fill 8 positions (Appendix\_\_). In addition, faculty voted to establish a position in CRSS for Dr. Andy Neal( located at the Savanna River Ecology Laboratory). Filling these positions will help to strengthen departmental programs.

## **VI. Summary/outline**

The Department Head of Crop and Soil Science at the University of Georgia is responsible for managing research, teaching and extension programs at the Athens, Griffin and Tifton campuses. Programs focus in 3 areas: biotechnology/molecular biology/cultivar development, environmental sciences/resource management and crop management. Faculty work on cotton; peanuts; soybeans; forages; tobacco; turfgrass; grains; water quality; soil, water and waste management; crop physiology; weed ecology and management; pesticide fate and carbon flux in crop canopies. The mission is discover new knowledge that is relevant to agricultural and the environment, develop practical methodologies and extend this information to user groups and other stake holders and be actively engaged in undergraduate and graduate educational programs that are both academically challenging and produce society ready students.

The departmental budget continued to decrease due to a reallocation for the assessment program. Consequently, the department focused on the most effective approach to maintaining its present strengths. Salary savings from vacant faculty and staff positions was used to support existing programs and fund the budget reductions. Faculty continued to increase extramural funding to replace state funding. The department also replaced state operational costs with non-state funds. The department now has the funding needed to proceed with filling 8 positions. Several innovative projects were undertaken by faculty to help ensure programmatic success utilizing innovative approaches.

State-wide student enrollment increased with the development of new majors and more effective recruitment. The department held the second teaching workshop which focused on the future of instruction in the department. Faculty discussed how to better manage our undergraduate and graduate teaching programs, class room renovation needs, state supported teaching assistantships and recruitment. Faculty agreed that participation in graduate and undergraduate student education at all three locations was important to the department.