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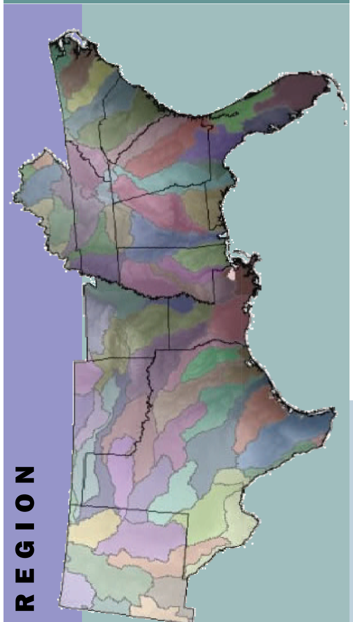

CSREES NUTRIENT MANAGEMENT IN THE SOUTHERN REGION NEWSLETTER

Nutrient Management in the Southern Region

Nutrient management research and education efforts are needed to address major regional problems associated with nutrient losses to surface waters and ground water. The multi-state, multi-agency Nutrient Management Workgroup is prioritizing needs and designing collaborative programs to support coordinated research and development of educational resources.

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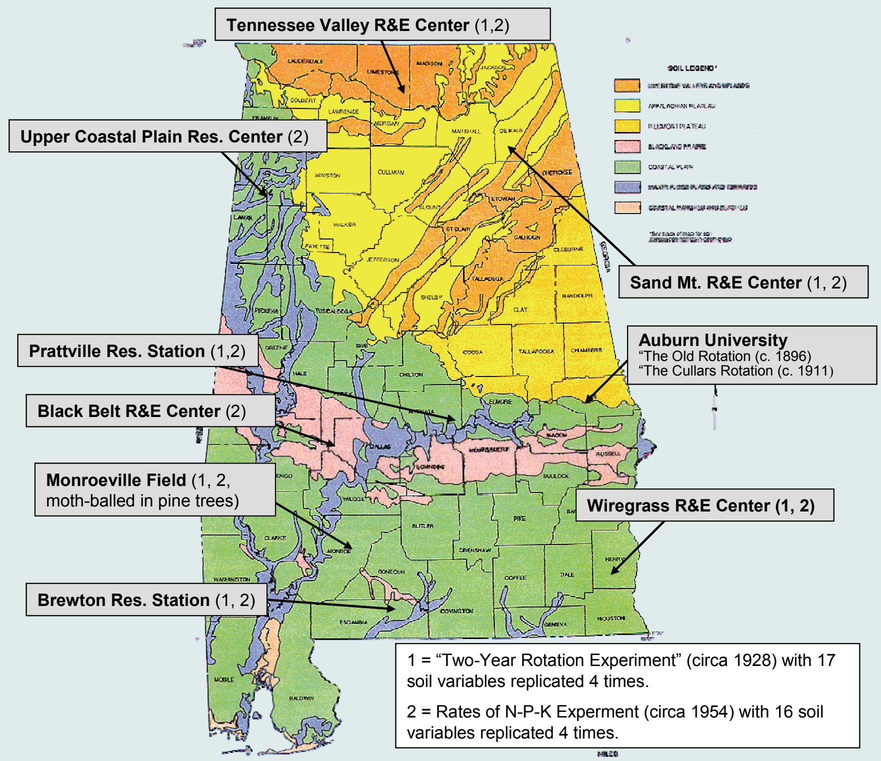
Soil Test Calibration is Changing in Alabama

Charles Mitchell, Extension Agronomist-Soils, Auburn University, Alabama

For almost 80 years, nutrient recommendations and soil test calibration in Alabama has come mostly from a series of long-term soil fertility experiments around the State. Some of these go back to 1928 when many of the outlying units of the Alabama Agricultural Experiment Station were opened. Others date from 1954 when the the first public soil testing laboratory in Alalbama began operation at Auburn University. For the most part, these experiments provided soil test calibration and nutrient recommendations for our major field crops: cotton, corn, soybeans, peanuts, and small grains.

The times, they are changing! With little public support for traditional soil test calibration research and commercial funding through large fertilizer and chemical companies drying up, the future of these experiments is in jeopardy. Two of the 15 oldest experiments have already been moth-balled by planting them to long leaf pine trees. Three others have been fallow with no crops on them. Three North Alabama tests were planted to tall fescue and then hybrid bermudagrass forage for a few years and are now in *Serecia lespedeza* forage. The others are maintained in cotton or cotton-soybean/ peanut rotations for the time being. But even these may be on the verge of change because of new trends and funding.



Locations of on-going, long-term soil fertility and soil test calibration experiments in Alabama.

The Two-Year Rotation at Sand Mountain Research & Extension Center used to be in a cotton and soybean rotation but is now planted in Serecia lespedeza. Similar experiments throughout the state may soon be converted to bioenergy crops and forages.

Bioenergy crops are hot! There's public funding for anything related to bioenergy. Therefore two experiments are being planted to switchgrass (*Panicum virgatum* L.) and big bluestem (*Andropogon gerardii* Vitman) to evaluate N recommendations and soil test P and K calibration for these potentially new crops. We also need to know the long-term effect of biomass removal on nutrient balances in our soils. The Two-Year Rotation experiment at Brewton will be planted to cogongrass (*Imperata cylindrica* L.). Yes, cogongrass, one of the most highly invasive weeds of the southern U.S. There is funding and we need to know how it will perform under different fertility levels. It is also a potential bioenergy crop. Proposals are to plant others in oilseed crops for biodiesel. Crops being considered are non-traditional such as sesame, castor bean, and sunflower in comparison with traditional soybean and peanut.

Traditional soil test calibration is changing from field crops to forages, weeds and potential bioenergy crops without changing the integrity of Alabama's long-term soil fertility experiments.

Nutrient Management Training and Practices in Mississippi

Larry Oldham, Extension Professor – Soils, Craig Coufal, Assistant Extension Professor – Poultry, Mississippi State University Extension Service

Over 2000 Mississippi farmers contract grew over 853 million broilers in Mississippi in 2006 as part of the state's one billion dollars in poultry related annual farm gate income. Most of this activity is in the Coastal Plain and Jackson Prairie regions of south central Mississippi. The Mississippi Department of Environmental Quality (MDEQ) issues environmental operating permits required of these operations under a general state permit. Nutrient management plans, usually prepared by local Natural Resource Conservation Service personnel, are part of the permit.

The general permit for poultry operations was revised in early 2004. During development, MDEQ worked with the Environmental Protection Agency, and other stakeholders including the Mississippi State University Extension Service and farm organizations, to meet federal expectations and to meet state needs. The revised permit defined broiler operations with more than 125,000 chickens present at any one time with a dry manure system or layer operations with more than 82,000 chickens using a wet manure system as Large Confined Animal Feeding Operations (CAFO's). The various agencies estimate about 25% of Mississippi operations are in this category.

The revised general permit includes provisions for required continuing education in technical topics for operations designated as large CAFO's on an annual basis. To implement the continuing education component MDEQ established a CAFO technical training advisory group with members from the agency, poultry growers, poultry integrators, and academia to recommend appropriate subjects and materials. MDEQ set the annual continuing education requirement at six hours following the group's recommendation. Training efforts may be stand-alone projects or existing forums or resources. Topics approved by the committee have included nutrient management, water management in the growing house, energy conservation, diseases, and biosecurity. The committee decided to focus on nutrient management in 2007 during the 2006 annual meeting.

Spreader calibration is one topic addressed in the Mississippi nutrient management educational programs. Photo:C.D. Coufal, MSU-ES

The Mississippi Poultry Association provided the logistics of four three-hour nutrient management education sessions in the state's poultry growing regions in early 2007. Mississippi State University Extension Service nutrient management and poultry specialists discussed nutrient cycling, agricultural-environmental issues, basic soils, soil testing, and Best Management Practices. An on-site evaluation of the four early 2007 sessions found that, on a scale of 1 to 5, with 5 optimal, the average response was approximately 4 for timeliness, usefulness, presentation, and impact of the program. With their permission, the sessions provided an opportunity to survey these CAFO managers about nutrient management practices.

The survey found that only wood bases are used for litter in production houses on these larger scale farms (six or more production houses). Half the attendees, averaged across locations, use litter treatment products such as alum, however within the four locations, use varied from 23 to 80%, indicating differing litter management programs are used by the integrators. Half the producers primarily land apply their litter to pasture or hay fields, a third sold or otherwise passed operational control, and about 7% of producers land applied to row crops. About half have never obtained a litter nutrient analysis, and over half performed total clean out of houses only at intervals greater than two years. These results indicate significant challenges in education and application exist for effective nutrient management, and that litter quantities may be less than previously thought due to decreased cleanout frequency.

The agricultural economy of the twelve south-central counties of Mississippi that grow about 80% of the broilers is based largely on timber and cattle, in addition to poultry. Dramatic increases in inorganic fertilizer prices due to demand, transportation, and supply issues in the 2007 crop year created more crop producer interest in alternative soil amendments. Mississippi NRCS initiated a transfer cost share program in 2006 under EQIP that funded about 70 contracts to move litter to row crop producers in counties without poultry growers. The program will repeat in late 2007 contingent on federal budgeting.

The nutrient management educational effort for CAFO managers will continue in September and October 2007 through interactive video sessions available through the MSU Extension Service system. Additional Extension programming efforts are targeting row crop producers concerning more efficient fertilizer management practices, the pros and cons of using poultry litter (and other organic fertilizers) in row crop production, and environmental responsibility.

Demonstration of Enhanced Technologies for Land Application of Animal Nutrient Sources in Sensitive Watersheds

Stephen F. Higgins and Donnie Stamper, University of Kentucky

Managing manure applications in a way that is not harmful to air, soil, and water quality is a difficult task. The goal of this project is to demonstrate state-of–the-art nutrient management technologies and application practices for the purposes of educating producers and custom waste applicators. The lessons learned in this project will allow producers to maintain current crop yields while maximizing nutrients found in manure. Learning new manure management techniques will give the producer a better idea of how to reduce leaching and off-site movement of nutrients. This project will be accomplished by the following objectives:

- Demonstrate a rapid on-farm model for determining total N and P contents from historical manure data and solids content.
- Demonstrate the efficacy of guidance aids and map-based manure application to reduce the potential for offsite nutrient movement in environmentally sensitive areas when used in conjunction with subsurface and aerated injection application systems.
- Demonstrate the use of variable-rate manure management and real-time solids content sensing for injection application systems.
- Quantify the environmental benefits and costs associated with producer adoption of one or more of these technologies and management practices.

For the past three years samples have been collected from eight earthen manure storage lagoons. These data will be analyzed in SAS to determine if they are statistically the same. Thus far, we can say that nutrient concentrations (N, P, and K) appear to be consistent over time. There have been some variations in nutrient concentrations between years.

To facilitate the project vacuum loading tanker was used to retrieve, transport and apply the nutrients stored in lagoons. The manure was applied using mulch tillage and injectors on a cooperator's farm in LaRue Co, KY for the past two years. The cooperator and his employees were impressed with the lack of liquid runoff using mulch tillage and injection applicators. The farm owner and employees were further impressed with the results from the yield data (Table 1). These data showed that 7,000 gallons of this particular hog manure produced the same yields as anhydrous ammonia.

Incorporation Method		
Tillage	Source (160 lb N)	Yield (bu/acre)
Check	NA	121
No-till	Effluent	157
No-till	Anhydrous	186
Aerway	Effluent	186
Aerway	Anhydrous	186
Injector	Effluent	210
Injector	Anhydrous	199

Table 1. Incorporation methods and nutrient sources with resulting yield.

Future demonstrations will utilize a tanker equipped with a flow meter and solids sensing device to control variable-rate applications. The tanker is already equipped with a hydraulic adjusted pinch valve for controlling flows. The purpose of this setup is to vary applications of wastes based on total solids content.

The rising cost of nitrogen fertilizers has resulted in producers looking at the economical benefits of using manure on their crops. Their willingness to be involved as cooperators and the interest shown by others at both demonstrations and field day displays indicate their desire to maximize their on-farm nutrient use so that they can save money. For example, the cooperator in LaRue Co. has traditionally used a traveling gun system to surface apply manure. It is well known that irrigation-style manure application has several associated problems, including increased volatilization and runoff.

Data indicate that farmers with multi-stage manure storage structures should consider changing their management practices. Typically, a producer will agitate and pump from the first stage pond containing the highest concentration of fresh effluent, which is also higher in total solids and phosphorus. This traditional practice is performed to remove

(Continued on page 5)

Comparing N Fertilizers

Sheri L. Cahill and Deanna L. Osmond, Soil Science Department, North Carolina State University, Raleigh

Farmers want to increase the nutrient efficiency of the fertilizer they use, especially now that the price has increased dramatically just over the past year. Slow release nitrogen fertilizers have potential to improve yield and nitrogen use efficiency (NUE) in crops such as winter wheat (*Triticum aestivum* L.) and maize (*Zea mays* L.). Recently in North Carolina, we compared a slow release urea formaldehyde polymer (UFP) with aqueous urea-ammonium nitrate (UAN) during a two-year field experiment. Crops were grown on very different soil types: Candor (sandy) and Portsmouth (mineral-organic) or Cape Fear (mineral-organic).

Treatments were N source (UFP and UAN) and N rate (0, 50, 78, 106, 134, 162, and 190 kg N ha^{-1} for wheat and 0, 39, 78, 118, 157, 196, and 235 kg N ha^{-1} for maize). Both sources were band applied as a split application for wheat, while maize received UFP at planting and split application of UAN (determined by label (UFP) or prior experimental experience (UAN)). Based on years of research, NC producers' apply less than one-third of UAN at planting, with the remainder applied prior to the end of tillering (wheat) or at V4-6 (corn). For both crops and both sites, grain yield and NUE with UAN were statistically similar to or better than UFP. Laboratory incubations suggested UFP release of urea and urea hydrolysis were complete in less than 2 weeks. The UFP release was limited to a time scale of days, considered insignificant for summer crop (corn) growth conditions. Since the UFP did not significantly improve yield, UFP may only be economical if priced similar to UAN. As new fertilizer products emerge on the market, it is important to compare their importance to traditional fertilizers.

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the solids that are displacing liquids and limiting storage capacity. However, this practice has increased fertility in the soils surrounding the farmstead with high concentrations of phosphorus that could potentially cause environmental harm. The option of hauling the liquid manures further down the road has not been performed, because of time and expenses needed to perform the task.

Manure samples collected by depth show that nitrogen concentrations in the second and third stage structures are consistent by depth, but much lower than the first stage pond. Although nitrogen concentrations are lower in the third stage pond, the inorganic nitrogen in the third stage is more inorganic and soluble and the phosphorus concentrations are much lower. Applying manures from the third stage first was recommended as an alternative management strategy that allows producers to apply a low concentration waste product. This alternative management approach allows more time for the solids in the first stage to breakdown, releasing more inorganic nitrogen to the second and third stage, while at the same time concentrating the phosphorus at the lower depths. We found that the alternative management approach is also beneficial because the typically producer is interested in applying waste volumes rather than nutrient applications based on manure analysis and crop removal rates. Therefore, utilizing this management approach, the producer will remove the volume needed to store more liquid wastes and meet crop nutrient needs by applying a low grade nutrient source that has more available nitrogen than a combination of fresh wastes containing organic and inorganic nutrient forms. The second aspect of this alternative management approach is to siphon liquid manures from the surface of the first stage structure, because phosphorus is directly correlated to solids. Using the alternative management strategy method allows the farmer to apply manures to soils that do not need phosphorus. Once the manure level reaches the higher concentrations of solids and associated phosphorus, the producer can agitate and haul the concentrated liquid further away from the farmstead to lower fertility soils that could use the phosphorus.

This project was funded through a USDA Conservation Innovation Grant. For more information about this project, please contact Steve Higgins at shiggins@bae.uky.edu or Donnie Stamper at Donald.stamper@uky.edu.

Quantifying the Economic and Environmental Benefits of Soil Testing

Mark L. McFarland, Soil Fertility Specialist, Dennis L. Coker, Extension Program Specialist, Brad Cowan, Hidalgo County CEA-AG/NR, Enrique Perez, Cameron County CEA-AG/NR, Texas Cooperative Extension

Soil testing is one of the most critical, and yet one of the most under-utilized best management practices available to agricultural producers. Proper plant nutrition is essential to ensure optimum crop growth and to maximize production economics. Just as importantly, improper rates, timing and/or application of fertilizer nutrients can contribute to water quality impairment. In Texas, multi-county assessments are used to demonstrate the magnitude of the economic and environmental benefits that can be realized through regular application of the soil testing best management practice.

As an example, a 4-county soil testing program was conducted annually in the fall-winter of 2001 through 2006 in the Rio Grande Valley of Texas. To implement the program, special regional educational events were conducted each year in the area. In addition, newsletters and news releases were utilized to educate and encourage agricultural producers to participate in the program. Producers were asked to provide the number of acres represented by each sample, crop and yield goal for the upcoming season, the anticipated fertilizer to be used, and the rate of application for each field. These data were used to estimate potential fertilizer savings and corresponding economic impacts resulting from the use of soil testing.

The program generated a total of 2,584 samples representing 106,609 acres. Projected fertilizer savings based on soil test results were an estimated 3,001,632 lbs of nitrogen and 3,373,366 lbs of phosphorus compared to rates planned before testing (Tables 1 and 2). These reductions in nutrient loading represent a reduced threat for potential impacts to surface and ground water resources. In addition, results indicate that producers could save from $9.46 to $25.07/acre by utilizing soil test results, depending on their crop and management history (Table 3). The total economic impact from the project was estimated at $1,821,293 based on average per pound costs for nitrogen and phosphorus. With recent sharp increases in fertilizer prices, the economic potential of soil testing will be even greater in 2008.

Table 1. Approximate Nitrogen Fertilizer Savings and Value (2001-2006).

County	2001	2002	2003	2004	2005	2006	Total	
	---Pounds---							Value
Cameron	74,980	104,116	196,523	89,153	240,134	228,468	933,374	$283,118
Hidalgo	139,198	38,997	46,645	349,307	510,842	142,079	1,227,068	$393,347
Starr	112,385	54,290	88,605	2,485	2,978	2,175	262,918	$61,400
Willacy	232,805	113,112	76,089	23,631	124,492	8,143	578,272	$149,231
Total	559,368	310,515	407,862	464,576	878,446	380,865	3,001,632	$887,096

Table 2. Approximate Phosphorus (P_2O_5) Fertilizer Savings and Value (2001-2006).

County	2001	2002	2003	2004	2005	2006	Total	
	---Pounds---							Value
Cameron	141,205	111,750	153,201	39,648	30,718	78,592	555,114	$151,740
Hidalgo	171,530	55,032	102,013	258,669	454,247	186,713	1,228,204	$351,118
Starr	172,470	255,455	178,008	3,029	3,238	4,797	616,997	$163,818
Willacy	317,495	165,910	194,253	25,642	246,587	23,164	973,051	$267,521
Total	802,700	588,147	627,475	326,988	734,790	293,266	3,373,366	$934,197

Table 3. Average $/A Savings on Nitrogen and Phosphorus (P_2O_5) from 2001-2006.

Crop	Acres	Value of N Saved	Value of P Saved	Total Value Saved	Average Value/Acre
Citrus	2,642	$50,088	$15,795	$65,883	$24.94
Corn	6,371	$71,484	$74,243	$145,727	$22.87
Cotton	28,320	$354,889	$338,564	$693,453	$24.49
Grain Sorghum	41,446	$208,590	$183,522	$392,112	$9.46
Imp. Bermuda	5,619	$34,079	$57,573	$91,562	$16.31
Watermelons	6,879	$37,618	$134,812	$172,430	$25.07
Sugarcane	5,596	$56,331	$37,002	$93,333	$16.68

Acknowledgments: This project is supported by the Cooperative State Research, Education, and Extension Service, U.S. Department of Agriculture through the Rio Grande Basin Initiative under Agreement No. 2001-45049-01149, and the 406 National Integrated Water Quality Program under Agreement No. 2004-51130-03114.

Growing No-till Corn on Residual Nutrients from Poultry Litter Applied to Cotton

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Due to high demand and an attractive price arising from its use as a biofuel crop, corn (*Zea mays,* L.) is becoming a very important crop for the south east U.S. Corn can be grown in rotation with cotton (*Gossypium hirsutum* L.), the major cash crop of this region to break life cycles of major cotton insect pests and diseases and also to supply crop residues needed to increase soil organic matter and reduce soil erosion. Soil erosion poses a threat to the sustainability of cotton production systems in the region. Also, in the south east U.S., the poultry industry is a major source of agricultural income. However, since the poultry industry is concentrated at both regional and farm levels, proper waste management is extremely important to sustain this burgeoning industry. The poultry industry in the south east U.S. currently faces a problem of limited choices of environmentally safe methods for disposal of poultry waste.

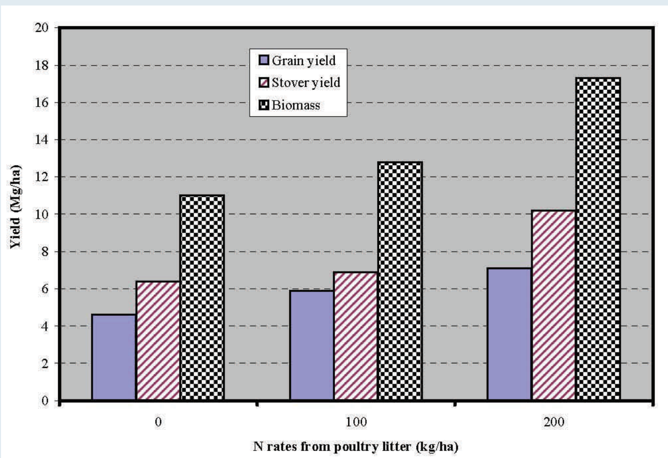

Figure 1. Grain, stover, and total biomass yields of corn under residual nutrients from poultry litter applied to cotton in north Alabama.

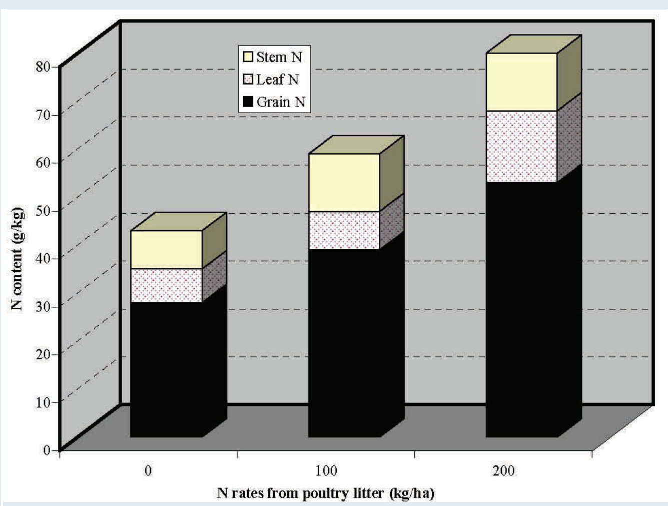

Figure 2. Nitrogen content of corn stems, leaves, and grain under residual nutrients from poultry litter applied to cotton in north Alabama.

We conducted a study to investigate the possibility of growing no-till corn on residual nutrients from poultry litter applied to cotton in conservation tillage production systems in north Alabama. The poultry litter used in this study was composed of a combination of accumulated broiler chicken manure and bedding materials, mainly sawdust, wood shaving, and wheat (*Triticum aestivum* L.) straw, with an average total N content of 2.85% on a dry weight basis, pH of 8.0, and a C/N ratio of 9 to 1. Poultry litter was applied as a N source for cotton in 1997, 1998, 2000, and 2001 at a rate calculated to supply 100 or 200 kg N ha^{-1}. Control plots did not receive any litter. Corn variety, Dekalb 687™ was grown as a rotational crop in 1999 and 2002 with and without additional N from inorganic ammonium nitrate fertilizer. The corn was no-till planted at a density of 30,000 plants acre^{-1}.

At physiological maturity, data for corn grain yield, biomass yield, and N content of corn grain and stover were collected. Residual nutrients from poultry litter applied to cotton to supply 200 kg N ha^{-1} produced 7.1 Mg ha^{-1} of corn grain yield, 10.2 Mg ha^{-1} of corn stover yield, and 17.3 Mg ha^{-1} of corn biomass without additional fertilizer (Figure 1). In addition, corn grain quality measured as grain N content almost doubled in plots which had received poultry litter at 200 kg N ha^{-1} under cotton (Figure 2). Our results showed that residual N from poultry litter applied to cotton was capable of meeting nearly half of the N requirements of the corn crop, which is a significant saving on the cost of N fertilizer. Also, cutting down the amount of inorganic fertilizer required to produce corn by close to 50% reduces the amount of nitrate and ammonium N which could potentially pollute surface and ground waters through leaching and surface runoff. Corn, which has a shallow fibrous root system and cotton, which has a deep tap root system are well suited for a crop rotation involving application of poultry litter. Unlike inorganic N fertilizer which releases N to the soil in a relatively short time period thereby resulting in a high concentration of excess nutrients which become susceptible to leaching, nutrient release from poultry litter occurs slowly over time. This gives the cotton crop a longer time to use the available nutrients especially below the top 30cm of the soil. Corn, on the other hand, is effective in removing the nutrient left by cotton in the upper soil layers. This complementary effect in nutrient usage is beneficial in reducing the risk of pollution of surface and ground water by excess N nutrients. Use of poultry litter to produce cotton and corn in rotation serves as an environmentally friendly way for the disposal of poultry litter produced in the region. Other benefits observed with growing corn on residual nutrients from poultry litter applied to cotton included higher soil moisture content in the top 10cm of the soil which could benefit corn germination and establishment in limited soil moisture conditions, reduced soil erosion potential, and increased soil C storage, and higher microbial activity.

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Tools to Promote Soil Testing by Urban and Non-Farm Clientele in Georgia

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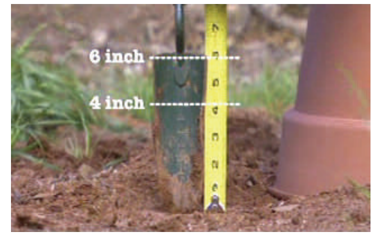
The Agricultural and Environmental Services Laboratories (AESL) of the University of Georgia works with County Extension Offices and research and extension faculty in the College of Agricultural and Environmental Sciences to provide leading laboratory services to clients throughout the state of Georgia. One of these services is soil testing.



Soil testing is an important component of good environmental stewardship. Often, homeowners, gardeners, and wildlife enthusiasts either over or under apply fertilizers. Too much fertilizer/lime can lead to environmental damage. Too little fertilizer and/or lime results in poor plant growth and could make soil prone to erosion.

In an effort to expand the reach of AESL's information campaign and highlight the services offered, a ten-minute education video was produced to introduce soil testing principles to these non-traditional clients. This video, *Don't Guess Soil Test*, introduces the non-traditional soil testing client to all the details needed for them to collect soil samples, submit samples to the laboratory, understand soil test reports, and how soil testing can help protect water quality   In addition to the full-length video short commercial/broadcast type videos on selected topics were produced to used as fillers in the Walter Reeves's *Gardening in Georg*ia show on Georgia Public Television.

Don't Guess Soil Test concludes with the host referring viewers to a website, www.soiltest123.com. This webpage serves as an information resource and for ordering soil testing kits online. We are working to unite the front in environmental awareness across our southern region by linking other state laboratories into our site. Also, other states in the southern region are using a generic version of our video to produce their own unique production. .

A prepaid/mail-in soil testing kit includes a soil test circular on how to sample soil in a lawn or garden. Kits are packaged in a manner that can be mailed, or potentially they may also be sold in retail gardening stores. In Georgia soil reports will continue to be returned through county extension offices. These kits will also increase awareness of our many environmental programs, offices, and services. DID YOU TEST YOUR SOIL BEFORE SPREADING FERTILIZER?

Funding for the video project was provided by CSREES Southern Region Water Quality Program-Special Project and UGA-Cooperative Extension.

http://srwqis.tamu.edu/nutrient-pesticide.aspx

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