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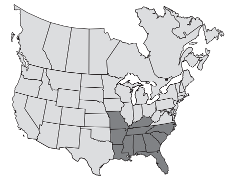
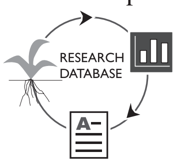


August 2010

Southeast Region Research Report

RESPONSIBLE management of crop nutrients requires research. Research is one step in the development process of best management practices (BMPs) that specify the right source of nutrient to be applied at the right rate, time, and place. Scientists need to test these practices for their impact on productivity, profitability, cropping system sustainability, and environmental health..



This issue of *INSIGHTS* features the brief Interpretive Summaries related to research projects supported by IPNI in the Southeast Region. This information and even more detail on each project can be found at the research database at our website: >**www.ipni.net/research**<.

Alabama

Evaluation of Rates and Timings of Liquid Nitrogen Fertilizer to Optimize Alabama Wheat Yields with and without Fall Tillage

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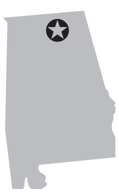
Project Cooperator: Kip Balkcom



This project, started in 2008, is being conducted at four locations throughout Alabama. The objectives of the study are to: 1) determine the optimum N fertilizer rate for Alabama wheat production, 2) evaluate timings of N fertilizer application on wheat yield, 3) determine if fall tillage is necessary to optimize wheat yields, and 4) evaluate the usefulness of leaf N content in determining N fertilizer requirements.

All test sites responded positively to N fertilization. The optimum N rate on the heavier soils in northern Alabama, which generally produced the highest wheat yields and test weights, was 60 lb/A applied in the spring. Residual N in the soil was also much higher at this site than the other locations as indicated by the near doubling of N content of tillers collected at the Feekes 4 growth stage (F4). Yield was maximized at three Coastal Plain (CP) sites when 20 lb N/A was applied in the fall followed by 70 lb N/A at F4. Waiting until F6 in the spring to apply N fertilizer reduced wheat yields at the CP sites. Wheat N content was low at all CP sites at both F4 and F6, indicating that fall N fertilization rates may need to be increased above the 20 lb/A rate tested in this study and that spring top-dress treatments may need to be applied at F4 or sooner.

Residual soil N measurements are inconsistent on Alabama soils; thus, the N tissue data collected from these tests should be useful in developing critical wheat tiller N concentrations needed on Alabama soils. The fall tillage comparison had no significant effect on any measured variable at any of the trial locations. In northern Alabama, the comparison was chisel plowing versus no-till, and in the CP it was surface tillage compared to a sub-soiler leveler treatment similar to a para-plow. *AL-19*

Ammonia Volatilization from Various Nitrogen Fertilizer Materials Following Application to a Bermudagrass Sod

Project Leader: Dr. Beth Guertal, Auburn University, Agronomy and Soils, Auburn, AL 36849. E-mail: eguertal@acesag.auburn.edu

The loss of N fertilizer applied as ammonia (NH_3) is a concern for turfgrass managers, particularly if supplemental irrigation is not applied to move the fertilizer from the turf surface into the soil. Our previous volatilization research has shown that as much as 0% of applied N can be lost to NH_3 volatilization when N is applied as urea, without irrigation. The purpose of this research was to examine NH_3 volatilization as affected by N source, examining ammonium sulfate as one of those sources. Four laboratory studies were completed with N fertilizer applied to the top of hybrid bermudagrass *(Cynodon dactylon x C. transvaalensis)* or overseeded hybrid bermudagrass *(Lolium perenne)* turf. Two different experimental procedures were used, including: 1) plot fertilization in the field, with soil sample cores taken at 2-day intervals for 21 days of laboratory analysis; and 2) a single extraction of unfertilized soil sample cores that were fertilized in the lab and observed for the entire 21-day period.

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Regardless of the method, NH_3 volatilization was always greatest from turfgrass that had been fertilized with urea. Turfgrass fertilized with ammonium sulfate or methylene urea consistently had lower levels of N loss as NH_3 through volatilization, usually close to zero. This experiment is on-going and will be repeated at several different temperatures, with and without irrigation. *AL-20*

Arkansas

Biomass and Macronutrient Accumulation and Losses in Switchgrass During and After the Growing Season in Arkansas

Project Leader: Dr. Charles West, University of Arkansas, Crop, Soil and Environmental Sciences, 1366 W Alteimer Dr., Fayetteville, AR 72704. Telephone: 479-575-3982. E-mail: cwest@uark.edu

Two switchgrass field studies were established at the University of Arkansas in 2008. One describes growing-season biomass accumulation and NPK uptake curves and the other determines N response curves for biomass yield. The first study consisted of 12 harvest dates, ranging from May to February. Trends in cumulative growth and nutrient concentration were fitted to regression models as a function of day of year. The 2009 data showed that growth followed a typical S-shaped curve. Peak yield occurred at the August 28 sampling date. Yields were essentially constant from September 30 to October 27, and then gradually declined to February 17, 2010. Nitrogen removal increased throughout the season to 76 kg/ha on July 31. Data from later sampling dates are not yet available. Potassium uptake peaked on July 1 at 136 kg/ha and declined to 110 kg/ha by July 31. Phosphorus uptake increased gradually up to July 31 to a relatively low level of 15 kg/ha. Soil test P level was 30 to 35 ppm in the surface 10 cm, which is not considered deficient for switchgrass. Completing the 2009 sample analyses for N, P, and K will shed light on uptake patterns as affected by crop maturity and senescence.

The second study includes treatments of urea applied at 0, 35, 70, 105, and 140 kg N/ha. One biomass harvest was taken in early October. Linear regression analysis of biomass yield showed a slightly positive slope that was not significantly different from zero, and with a very low R^2 . The lack of significant response to N fertilizer was unexpected; however, switchgrass and other native grasses are known to be efficient in their use of plant available N and do not always show a response. There was inconsistent response of switchgrass growth to N application within the four replications, which were blocked across the field area. There was also variation in plant population density. Switchgrass was seeded in 60 cm spaced rows in early July 2008, and not all rows achieved solid stands. Therefore, the first production year, 2009, consisted of fairly young plants, with some gaps between them. It is expected that in 2010 the plants will tiller out more and fill in the gaps more evenly, resulting in less yield variation within treatment. *AR-33*

Florida

Influence of Pre-plant Nitrogen and Sulfur Sources on Strawberry

Project Leader: Dr. Bielinski Santos, University of Florida, Gulf Research and Education Centern, 14625 CR 672, Wimauma, FL 33598. Telephone: 813-633-4128. E-mail: bmsantos@ufl.edu

Project Cooperator: Henner Obregon

A field study was conducted to compare the effects of diverse pre-plant N and S fertilizer sources on early strawberry yields using the 'Strawberry Festival' variety. The fertilizer sources were ammonium sulfate (21% N, 24% S at 50 lb N/A and 57 lb S/A); ammonium nitrate (34% N at 50 lb N/A); polymer-coated ammonium sulfate (20% N, 23% S at 50 lb N/A and 57 lb S/A); ammonium sulfate nitrate (26% N, 14% S at 50 lb N/A and 27 lb S/A); and gypsum (18% S at 27 and 57 lb S/A). A non-treated control was also included. The fertilizers were applied one week before transplanting and broadcast and incorporated into the top 2 in. of the soil.

There were no differences among treatments for foliar N and S concentrations at 6 weeks after treatment, chlorophyll content (measured as leaf greenness) at 7 and 10 weeks after treatment, plant diameter at 6 and 14 weeks after treatment, and early fruit weight and number after the first 10 harvests. *FL-27F*

Georgia

Loblolly Pine Stand Fertilization at Mid-Rotation to Increase Small and Large Sawtimber Volume in Georgia

Project Leader: Dr. E. David Dickens, University of Georgia, Warnell School of Forest Resources, PO Box 8112, Statesboro, GA 30460. Telephone: 912-681-5639. Fax: 912-681-0180. E-mail: ddickens@arches.uga.edu

Project Cooperator: David Moorhead

Two fertilizer trials and an untreated control were established in 2004 near Bullard, Georgia, within a loblolly pine tree stand planted in 1978 and thinned in 2002-03. The objectives of the study were to: 1) quantify the magnitude and duration of wood volume response to various fertilizer combinations, 2) determine changes in product class distribution, 3) determine the cash flow and rate of return for each fertilizer combination compared to unfertilized control plots, and 4) discern when fertilizers are to be re-applied to maintain wood volume gain. Fertilizer treatments examined NP, NPK, and NPKSCu in one trial and NP, NPCu, NPKCu, and NPKSCu in a second trial. The one-time fertilizer applications were applied in February 2005. Fertilizer levels applied per acre were 200 lb N, 50 lb P, 80 lb K, 60 lb S, and 5 lb Cu.

Data (4-year) were collected in January 2009. There were significant differences in 4-year growth increment for diameter as the control (0.883 in.) was significantly less than treatments supplying NP (1.02 in.), NPKCu (1.07 in.), and NPKSCu (0.963 in.). The volume per tree measurements were also significant with the control being significantly less than all fertilizer treatments. The NPKCu treatment had significantly greater volume per tree increment (4.1 cubic feet) than all other treatments except the NP treatment (4.0 cubic feet). There were no significant growth increment differences amongst treatments for trees per acre, diameter, height, live crown ratio, or volume per acre during the second measurement period (2007 to 2009). However, there were significant volume per tree differences for the 2007 to 2009 growth increment with the NPKCu treatment being significantly greater than the control and NPCu treatments. *GA-26F*

Louisiana

Effects of Potassium and Chloride with and without Manganese and Boron on Asian Soybean Rust in Louisiana

Project Leader: Dr. Raymond Schneider, Louisiana State University, Department of Plant Pathology & Crop Physiology, 302 LSB, Baton Rouge, LA 70803. Telephone: 225-578-4880. E-mail: rschnei@lsu.edu

Project Cooperator: Jim Wang

A comprehensive field experiment was conducted at the Ben Hur Research Station near Baton Rouge, Louisiana, in 2009. Main treatments included three rates of calcium chloride ($CaCl_2$) and potassium chloride (KCl) each, applied in a pre-plant operation. These six treatments were split three ways with foliar applications of Mn, B, and Mn+B. The control included micronutrient applications alone and a non-amended treatment. The trial was planted in July with a maturity group VI cultivar so that it would be in a susceptible stage in mid-September when soybean rust usually begins and progresses to high severity levels. Disease severity was measured at the mid-R6 stage and plots were harvested for yield determination.

Plots with intermediate and high levels of both $CaCl_2$ and KCl had very low levels of disease severity, while the lowest levels of application had relatively high disease severity. There were significant interactions between the Cl^- amendments and the micronutrient supplements. In particular, those treatments receiving B had significantly less disease except in the high KCl and high $CaCl_2$ treatments. However, plots receiving B alone had among the lowest disease severity scores of any treatment.

In conclusion, Cl^- amendments, regardless of the accompanying cation, provided a moderate level of disease control, while the high level of disease control with B suggests that these mineral supplements have different modes of action. In all cases, disease severity eventually reached the same levels as the non-treated control, but this occurred at the late R6 and early R7 growth stages, which are generally considered to be beyond the point where foliar diseases would be expected to impact yield. As a practical matter, foliar applications of B would be a simple practice. *LA-22*

Precise Mid-Season Nitrogen Rate Determination for Use Efficiency and Yield Optimization of Rice

Project Leader: Dr. Dustin Harrell, Louisiana State University, Rice Research Station, 1373 Caffey Road, Rayne, LA 70578.

Project Cooperators: Brenda Tubana and Tim Walker

The development of a more profitable and environmentally-sound production system is essential to maintain a competitive rice industry in the Mid-South region of the United States. Nitrogen fertilizer is one of the major agricultural inputs in rice production. This project was conducted in 2009 to update a working algorithm of a sensor-based N decision tool for estimating the mid-season N requirement of rice. The components of the working algorithm include a yield potential predictive equation and an in-season estimate of responsiveness of rice to N fertilization. Sensor readings were collected from seven (variety x N) trials established in Crowley and Rayville, Louisiana, and in Stoneville, Mississippi, once a week for five consecutive weeks starting at panicle initiation. Prior to regression analysis, all data were grouped in two ways: 1) according to the number of days from seeding to sensing (DAS), and 2) according to cumulative growing degree days (GDD).

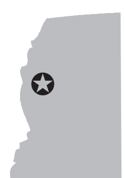
The highest association ($r^2 = 0.59$) between actual grain yield and the sensor-based yield estimate was obtained from the 1,701 to 1,900 GDD group. A rice grain yield potential predictive equation was developed using these data. A mid-season estimate of rice response to N was predicted using a second equation. Generally, the sensor-based N decision tool made mid-season N rate recommendations that resulted in total N inputs close to optimal N rates for each site. In most cases, variably applying mid-season N to rice based on sensor readings resulted in higher N use efficiency and net economic return. *LA-23*

Mississippi

Precise Mid-Season Nitrogen Rate Determination for Use Efficiency and Yield Optimization of Rice

Project Leader: Dr. Timothy Walker, Mississippi State University, Delta Research and Extension Center, PO Box 197, Stoneville, MS 38776.

Project Cooperators: Dustin Harrell and Brenda Tubana



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Nitrogen Uptake, Residual Effects, and Nitrogen Translocation in Alamo Switchgrass

Project Leader: Dr. Rocky Lemus, Mississippi State University, Plant & Soil Science, Mississippi State, MS 39762. Telephone: 662-325-7718. E-mail: rlemus@pss.msstate.edu

Project Cooperator: Jack Varco

The main objectives of this study were to determine N translocation in switchgrass throughout the growing season as well as the best nutrient management practices by estimating N residual effects on biomass production, quality, and time of N fertilizer applications. Three N treatments (0, 56, and 112 kg N/ha) were applied to plots as ammonium nitrate. Double-labeled ammonium nitrate (^{15}N at 2.5% enrichment) was applied to a 1.5 x 1.5 m area in each plot. Plant shoot and root (crown + root) tissue and soil samples were collected on August 4 and November 11 of 2009 and on February 17, 2010. Shoot samples were collected using a 1 x 1 m area and stubble height of 8 cm. Root samples were collected using a 0.3 x 0.3 m area and a 15 cm depth. Ten soil core samples were collected within each plot to a 15 cm depth. Soil samples were weighed and air-dried to obtain soil bulk density data and soil water content at time of each sampling date. Soil samples were ground to pass a 2 mm mesh and saved for analysis. Roots samples were washed and separated into crown and root tissue. Yield data were collected on November 11 of 2009. Residual sampling will be continued in May, August, and November of 2010.

A linear increase in seasonal yields was observed, but mean separations were not statistically significant. Yields at 56 and 112 kg N/ha were 23% and 24% higher than the control, respectively. All collected samples are being analyzed for ^{15}N, C, P, and K. *MS-17*

South Carolina

Incorporating Soil Electrical Conductivity in Developing Variable Nitrogen Application for Corn in the Southeastern U.S.

Project Leader: Dr. Pawel Wiatrak, Clemson University, Department of Entomology, Soils and Plant Sciences, 64 Research Rd., Blackville, SC 29817. Telephone: 803-284-3343 x261, Fax: 803-284-3684. E-mail: pwiatra@clemson.edu

Project Cooperators: Ahmad Khalilian, David Wallace, and Ymene Fouli

The long-term goal of this project is to develop procedures for a site-specific, variable N application strategy for corn based on the spatial variability of soil texture and corn grain yield. The aim is to increase farm sustainability and develop environmentally sound corn production system. In 2009, studies were conducted at two Clemson University experiment stations and six grower fields throughout South Carolina.

Corn yields were generally reduced due to insufficient precipitation in June and July in 2009. Despite reduced yields, the results from the studies showed that optical sensing technology used in conjunction with soil management zones based on electrical conductivity (EC) can be successfully used to help growers improve profitability by optimizing N application rates. The sensors improve profitability by optimizing N application rates. The sensor-based system successfully showed that the grower fields used in this study did not need to apply any sidedress N in 2009 due to the reduced yield potential resulting from the drought. Nitrogen rate calibration strips in each field validated these recommendations. There is still a need to refine the existing algorithm by adding additional years (2008 was also extremely dry for optimal corn production). Therefore, the study on refining and evaluating the algorithm will continue in 2010. Soil zones based on EC influenced corn yields with the highest yields being observed in soil zones 2 and 3 (sandy loams and loamy sands in this experiment) due to relatively higher moisture and nutrient holding capacity (which are especially critical parameters affecting grain yield potential during drought stress) compared to soil zone 1 (mostly very sandy soils). Tillage system (tested only at one of the experiment stations) also affected grain yield with significantly higher corn yields being obtained following conventional tillage compared to no-till, but there was no difference between strip-till and no-till. Soil nitrate-N concentrations decreased with increased soil depth under conventional and strip-tillage, but didn't change under no-till for soil zones 2 and 3. However, soil nitrate-N increased with depth for soil zone 1 under all tillage systems. Therefore, variable N recommendations need to be used to improve N use efficiency for dryland corn and reduce water pollution. *SC-14* ■

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