IPNI INSIGHTS
INTERNATIONAL PLANT NUTRITION INSTITUTE

July 2009

Southeast Region 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 was started in the fall of 2008 at the Tennessee Valley Research and Extension Center in northern Alabama. The objectives of the study were to: (1) determine the optimum N fertilizer rate for Alabama wheat production; (2) evaluate timing of N fertilizer treatments 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.

The wheat response to N rates in this test supported the current Auburn University recommendation of 20 lb of N fertilizer applied in the fall followed by 60 to 80 lb of N applied in the spring. Splitting N rates in the spring showed very little benefit except at the low (60 lb N/A) rate with no fall N application. Fall N fertilizer application was especially beneficial when total N fertilizer rates of 60 and 90 lb N/A were applied. Fall tillage had no significant effect on wheat yields in 2008. Low N recommendations were generated in this study using Virginia's relationship between wheat tissue N and fertilizer N requirement where no N had been applied. This method accurately predicted no additional N fertilizer requirement where 120 lb N had been applied. Gathering more data on this relationship under Alabama conditions may provide a useful tool for Alabama wheat growers. *AL-19*

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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 production field studies were established at the University of Arkansas Agricultural Research and Extension Center in July 2008. Switchgrass generally produces very little above-ground growth in Year 1 as it allocates a large amount of energy to its strong root systems. Harvestable biomass accumulates in Year 2, while maximum yields occur from Year 3 onward. Thus, data from these studies will be collected in Years 2 and 3 (May 2009 to February 2011). One study will describe growing-season biomass accumulation and NPK uptake curves for switchgrass grown for biomass and the other will determine N response curves for biomass yield in second- and third-year switchgrass stands. The first study will consist of 12 harvest dates, ranging from May to February. Trends in cumulative growth, moisture concentration, and nutrient concentration and removal will be fitted to regression models as a function of day of year and accumulated growing-degree days. Regressions will be tested on two phases of the year, in-season from May to September, and post-season from October to February. The second study will include treatments of urea applied on April 1 at the rates of 0, 35, 70, 105, and 140 kg N/ha. One harvest per year will be taken in early October for moisture content and biomass yield. Plant

biomass will be sampled to determine N concentration and to calculate N removal and apparent N recovery. *AR-33*

Florida

Effect of Potash, Manganese, and Boron on Asian Soybean Rust in Soybean Grown in Florida

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Project Cooperators: Jim Marois and Tristan Mueller

The objective of this experiment was to determine the efficacy of in-furrow application of Cl^-, through either potassium chloride (KCl) or calcium chloride ($CaCl_2$), plus foliar application of B at 0.25 lb B/A and Mn at 0.5 lb Mn/A for the control of soybean rust. Soybean variety Asgrow 6301RR was planted at the North Florida Research and Education Center in Quincy in 4-row plots with a 2-row border between plots. Plots were 18 ft. long, with a 36-in. row spacing.

A platform sprayer using 16 gallons of water per acre applied B and Mn on August 5. Soybean plants were rated for soybean rust on September 12 and again on September 22. The middle two rows of each plot were harvested on October 28 and yield was adjusted to 13% moisture. Soybean rust was severe in all plots (69 to 75% infected plants). There were no significant differences in soybean rust severity, leaf area index, defoliation, yield, or seed weight with any other treatment compared to the control. *FL-23F*

Natural Climatic Forcing and Mississippi River Discharge as a Control on the Development of the Louisiana 'Dead Zones'

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The objectives of this research, initiated in 2007, have been to evaluate the roles that natural climate variability and Mississippi River (MR) discharge have on controlling the development, intensification, and expansion of hypoxic "dead zone" conditions on the Louisiana (LA) continental shelf. The geochemical and faunal analyses from a series of sediment cores show that low-oxygen conditions occurred repeatedly prior to anthropogenic influences and that these events are directly associated with times of enhanced MR discharge and the dominant input of terrestrial organic matter (OM) and sediments. Further examination of this suite of sediment cores, albeit geographically limited, suggests that the aerial extent of the pre-anthropogenic low-oxygen events were similar to that observed in recent times. These preliminary results strongly suggest that climate variability and its control on MR discharge volume are important processes that need to be considered when evaluating the causes and consequences of the recent development and expansion of hypoxic conditions.

Climate variability is known to influence atmospheric circulation patterns, the transport of evaporated moisture from the Gulf of Mexico to North American regions (as precipitation) and the volume of MR discharge. Precisely correlating the timing of the pre-anthropogenic low-oxygen events to known climatic conditions using the LA shelf cores is impossible due to the effects of storm events on sediment transport, deposition, and age dating. To address this problem we initiated a parallel study on a well-dated sediment core from the Pigmy Basin (PB), located in deeper water (1,800 m) on the continental slope. Well-defined temporal changes in the input of terrestrial OM and specific sedimentary components provide a direct proxy for the MR discharge volume, variations in regional patterns of precipitation and input, and the temporal frequency of major MR discharge events. Results indicate that MR discharge volume regularly varied significantly over the past 1,400 years with multi-decadal frequency. *FL-26F*

Influence of Sulfur Fertilization in Peppers and Tomatoes in Florida

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

Project Cooperator: Henner Obregon

A field study was conducted at the Gulf Coast Research and Education Center, University of Florida, between February and May 2008 to determine the effect of different pre-plant N and S fertilizer sources and rates on the growth and yield of 'Aristotle' bell pepper. Fertilizers were applied two weeks after transplanting (WAT) in two bands on bed tops at 6 in. from either side of the planting row and incorporated to a 1 in. depth. Fertilizer sources were ammonium sulfate (AS; 21% N, 24% S), ammonium nitrate (AN; 34% N), and fusion ammonium sulfate nitrate (FASN; 26% N, 14% S) – a possible replacement for AN that can provide proper amounts of plant available S. Fertilizer rates were 100, 200, and 300 lb/A of N, AS, and FASN which supplied 114, 228, and 342 lb S/A and 54, 108, and 162 lb S/A at their corresponding N rates, respectively.

Data showed no significant differences in plant vigor and height at 6 WAT, nor in petiole sap nitrate-N (NO_3-N) concentration at 8 WAT. However, there were significant effects of N sources and rates on bell pepper fruit weight. When N rates increased from 100 to 200 lb N/A, bell pepper yields increased 14%, regardless of N source, with no further yield change with higher N rates. However, AS and FASN improved bell pepper yields by 9% and 10%, respectively, in comparison to AN at 200 lb N/A. There were no significant differences on bell pepper yield when AS or FASN were used at rates of 200 or 300 lb N/A. More research is needed to confirm these preliminary results. *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.

There was a significant difference in 2-year wood volume per tree increment. The loblolly pine trees within control plots grew an average of 2 cubic ft., significantly less (50%) than the NP treatment which grew 3 cubic ft., and the NPKCu treatment which grew 2.6 cubic ft. Although non-significant, other growth increment differences are of interest. Control plot mean height increment was 3.4 ft., whereas the NP treatment was 5.1 ft. (50% greater height increment) and the NPCu, NPKCu, and NPKSCu treatments grew by 4.9, 4.8, and 4.7 ft., respectively, within the 2-year period. Total volume per acre growth increments were 323 cubic ft. for the control to 449 cubic ft. for the NPKCu treatment, a 39% gain in 2 years.

It is too early to pass major judgment on a crop with a 30 to 40 year rotation, but some trends are showing promise. Mean height increment, volume per tree, and volume per gains are large for just a 2-year period. We will know more after our 4-year measurements (collected in late-January 2009) where fertilizer gains (diameter and volume) typically tend to peak. *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

The objective of this project was to determine if Asian soybean rust (ASR) is affected by soil amendments of potassium chloride (KCl) or calcium chloride ($CaCl_2$) or foliar applications of Mn and B. Three rates of Cl^- (27, 40, and 53 lb Cl^-/A) were applied immediately after planting in late-June as a 12-in. band over the seed furrow. Foliar applications of Mn and B were made at the first flower stage (R1). Soybean rust was rated within the mid and upper canopy in early October. The disease begins in the mid canopy and progresses most rapidly on these older leaves. Therefore, these ratings reflect the most severe aspect of the disease, while upper canopy ratings are related to the spread of the disease from the lower part of the plant. Upper canopy leaves are younger and more resistant to infection and would have been infected for a shorter period than mid canopy leaves.

For soybean rust at mid canopy, the most effective treatments were high rates of KCl and $CaCl_2$. This confirms findings from previous years in which Cl^- appears to be the active agent rather than accompanying cation. The same trend was observed in upper canopy disease development. Foliar applications of Mn, either alone or in combination with other treatments, appeared to reduce disease severity. The study was affected by Hurricane Gustav to the point that the plots could not be harvested. However, rust severity evaluations are reliable because the disease was readily quantifiable, and only those sections of row that were not physically damaged were rated. *LA-22F*

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

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

Project Cooperators: Brenda Tubana and Tim Walker

Nitrogen fertilizer is one of the major agricultural inputs in rice production and development of a more profitable and environmentally-sound production system is essential to maintain a competitive rice industry in the Mid-South. This project was initiated in 2008 to develop an optical sensor-based functional algorithm that will be used for estimating mid-season N requirement of rice. Essential components of the algorithm that need to be established for this region include: (1) a yield potential predictive equation; and (2) an in-season estimate of responsiveness of rice to N fertilization. Sensor readings were collected from seven variety x N trials established at three sites in Louisiana. For different growth stages, the association of in-season estimated yield (using an experimental predictive equation) and actual grain yield was evaluated.

Between 70 to 90 days after seeding (DAS), strong associations between the predictive equation (developed from sensor data collected at 70 to 75 DAS) and grain yield were obtained. While there was a strong relationship between sensor-based estimates of response to N fertilization and actual increase in grain yield attributed to N fertilization at 76 to 80 DAS, more data points are needed to obtain a

better estimate of N responsiveness earlier in the season. The preliminary results showed that both in-season yield potential and response to N fertilization of rice can be estimated using optical sensor measurements collected between 70 to 90 days after seeding. With a promising start, additional research is needed to refine the components of the proposed need-based N management scheme using remote sensors. *LA-23*

Missouri

Crop Sensors for Variable-Rate Nitrogen Application to Cotton in the Mid-Southern United States

Project Leader: Dr. Peter Scharf, University of Missouri, Department of Agronomy, 210 Waters Hall, Columbia, MO 65211-6140. Telephone: 573-8825-0777. E-mail: scharfp@missouri.edu

Previous work has shown that the most profitable N fertilizer rate for cotton in Missouri can range from 0 to 200 lb N/A. A typical producer fertilizer rate is 100 lb N/A, with little or no adjustment for different fields or different places in fields. When a producer's fertilizer rate is less than what the crop needs, potential yield is lost. When a producer's fertilizer rate is more than what the crop needs, excess vegetative growth can occur and cause harvest delays, increased insect or disease pressure, and/or increased expenses for growth regulators and defoliants. Crop sensors are a promising new way to diagnose how much N a crop needs. This research project has demonstrated over the past 3 years that there is a good relationship between optical sensor measurements collected mid-season and N need in cotton. This relationship was evaluated in a 40-acre demonstration field in southern Missouri in 2008.

Sensors were mounted on the front of a fertilizer applicator and sensors sent a signal once per second related to how much fertilizer the cotton crop needed. The applicator varied the fertilizer rate applied according to these signals. Good yields were produced with less N fertilizer than the producer would have used normally. Further analysis of the yield map from the demonstration field will allow conclusions to be drawn regarding the economic impact of variable-rate N fertilization in cotton. *MO-33*

Mississippi

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

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

Nitrogen fertilizer is one of the major agricultural inputs in rice production and development of a more profitable and environmentally-sound production system is essential to maintain a competitive rice industry in the Mid-South. This project was initiated in 2008 to develop an optical sensor-based functional algorithm that will be used for estimating mid-season N requirement of rice. Essential components of the algorithm that need to be established for this region include: (1) a yield potential predictive equation; and (2) an in-season estimate of responsiveness of rice to N fertilization. Sensor readings were collected from seven variety x N trials established at three sites in Mississippi. For different growth stages, the association of in-season estimated yield (using an experimental predictive equation) and actual grain yield was evaluated. *MS-16*

South Carolina

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

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

This study was conducted in 2008 at the Clemson University, Edisto Research and Education Center near Blackville, South Carolina, to develop procedures for a variable N application strategy for corn based on spatial variability in soil texture. The specific objectives are to: (1) determine the optimum N rates for corn in relation to soil spatial variability; (2) quantify nitrate-N (NO_3^--N) and other nutrient leaching in the soil; and (3) work with farmers to evaluate the effectiveness of the site-specific N application technology in increasing profitability and preserving soil environmental quality. Prior to planting, soil electrical conductivity (EC) measurements were used to identify variations in soil texture across the field and create soil zone maps using GPS and Geographic Information Systems (GIS). Fields were divided into four different soil zone areas based on the EC measurements. Each soil zone area was split into three tillage systems (conventional, strip-till, and no-till), two methods of N application (all at once at planting and as a split application with 30 lb N/A applied at planting and the rest as a sidedress application), and five N rates (0, 40, 80, 120, and 160 lb N/A). *SC-14* ■

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