INSIGHTS
IPNI
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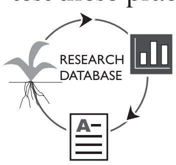
Southeast Region Research Report

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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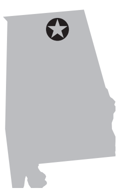

This was the third year of the project to evaluate N fertilizer rates and timing for wheat on different soils in Alabama. A tillage variable is also included. Data collected from the test sites include wheat tillering counts and weights, leaf-N values at Feekes growth stage 4 and 6, and moisture, test weights, and yields at harvest.

The 2009-2010 growing season in Alabama was not optimum for wheat production. A wet fall delayed wheat plantings and wet conditions in January and February delayed N applications in many areas. Four test sites were established, but one site had to be abandoned due to poor stands. In 2010, wheat tillering rates and N content were much lower at all locations than in previous years. Applying 20 lb N/A at planting did increase tillering rates at all sites, but they were still low compared to previous years. Non-inversion tillage increased wheat yields compared to conventional tillage at the two test sites located on sandy soils in central and south Alabama, but no-tillage produced equivalent wheat yields compared to conventional tillage on the silty clay soil test site in northern Alabama. In these tests wheat yields were lower than normal, but generally responded to higher N rates than seen in previous years. Early timing of N applications (Feekes 4) was critical especially on the sandy soil sites. Residual soil N measurements are inconsistent on Alabama soils.

This year's data support the use of tiller counts and tissue N concentrations in timing N fertilizer applications. The three years of data also indicate that on the sandy soils in Alabama, fall N fertilizer rates may need to be increased or spring N applied sooner to maximize wheat tillering and yields. The silty clay soils of northern Alabama generally have higher residual soil N values, but this year's data also support the use of tillering rates and N concentration for timing of N applications on these soils. *AL-19*

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Arkansas

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

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A switchgrass growth and composition trial was conducted in 2009 and 2010 at the University of Arkansas. The trial consisted of 12 sampling dates from early May to mid-February. For the 2009-10 growing season, peak yield (6.25 t/A) occurred at the August 28 sampling date. Yields were essentially level from September 30 to October 27, and then followed a gradual decline until February 17, 2010. Moisture content declined linearly in-season and curvilinearly post-season, attaining levels safe for storage of direct-chopped biomass in December onward (<20%). Cutting the stand crop at dates through November would require field curing before packaging and transport

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to safe storage because of excessively high moisture. Data for the 2010-11 harvest year trended similarly to that of 2009-10. In 2010, moisture content declined to around 50% by September 28. After October 26, moisture content declined more sharply, reaching 16% by December 20. As in 2009, crop moisture content was not safe for direct chopping and immediate storage before December. Nitrogen, P, and K concentrations were determined on sub-samples to determine uptake and removal in the harvested biomass. In 2009, N uptake exhibited a broad peak between July 3 and Sept. 27. The peak N removal was 71 lb N/A on August 28, the same day as peak biomass yield. The senescent period showed N removal rates reduced to about half the peak level, ending at 26 lb N/A in mid-February. Potassium uptake peaked on July 3 at 121 lb K/A (2 months before peak biomass yield) and declined to 20 lb K/A by February 17. There was substantially more K than N removed during June through August, but they declined to similar low levels by winter. Interestingly, peak dates of N and K uptake did not coincide. Phosphorus uptake increased gradually and at very low levels (14 lb P/A) to July 31, then declined to nearly zero by mid-February. Loss of all three nutrients in the latter half of the sampling year likely resulted from a combination of leaf and seed droppage (not measured) during senescence, re-mobilization of mobile nutrients for next year's growth to roots and the crown, and by leaching from the leaves. *AR-33*

Florida

Bahiagrass Production and Nitrogen Leaching from Various Nitrogen Fertilizer Sources

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Bahiagrass covers nearly 5 million acres in Florida and is the most widely used improved grass in the state. This grass requires relatively moderate amounts of N for optimum production and can efficiently respond to inorganic fertilizer application. Nitrogen fertilizer can increase both yield and nutritive value of bahiagrass pastures, particularly in low fertility Coastal Plain soils, where N is often the most limiting nutrient for forage production. Although N is an important agronomic input for productive bahiagrass pastures, the increasing costs of commercial fertilizers and environmental problems associated with improper fertilization management have prompted the need to re-examine optimum rates and efficient sources to supply pastures with N. This experiment was designed to examine the effectiveness of various N sources on bahiagrass dry matter yield, nutritive value, and N leaching potential. Nitrogen was applied at 0, 50, and 100 lb/A/yr as ammonium nitrate (AN), ammonium sulfate (AS), urea, and ammonium sulfate nitrate (ASN) on Basinger fine sand. The study was conducted at the Range Cattle Research and Education Center in Ona, Florida, during May to November, 2010.

All N fertilizer sources increased cumulative bahiagrass dry matter yield by approximately 69% comparedto control plots (no N applied). Bahiagrass yields responded linearly as N rates increased from 0 to 100 lb/A. Bahiagrass crude protein concentration was not significantly affected by N source. There were no significant differences in bahiagrass crude protein concentrations between the control plots (CP = 7.6%) and the treatments receiving 50 lb N/A treatment (CP = 7.7%). However, application of N at rates of 100 lb N/A resulted in higher CP concentrations (CP = 8.7%). Nitrogen leaching as nitrate (NO_3-N) and ammonium (NH_4-N) was not significantly affected by either N source or N rate. Results indicated that N leaching from plots receiving N fertilizer was similar to control plots (no N added). Nitrate and ammonium concentrations for all treatments did not exceed the acceptable environmental threshold and likely do not pose any serious threat to the environment. *FL-29F*

Louisiana

Precise Midseason 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 Cooperator: 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 USA. Nitrogen fertilizer is one of the major agricultural inputs and is considered as the most expensive plant nutrient in rice production. This project was continued in 2010 to: 1) update the working algorithm of the proposed sensor-based N decision tool for estimating midseason N requirement of rice; 2) evaluate the performance of the 2009 sensor-based N decision tool; and 3) address the issue on water reflectance interference on sensor readings. Sensor readings were collected from seven variety x N trials established in Louisiana and Mississippi once a week for five consecutive weeks starting at panicle initiation.

Regression analysis was performed after the data from 2008 to 2010 were grouped by growing degree days (GDD) and adjusted using days from seeding to sensing (DAS). For the 1,501 to 1,700 GDD group, where the majority of the site-years were at or close to panicle differentiation, the coefficient of determination value (r^2) of the predictive model for grain yield potential using the normalized difference vegetation index (NDVI)/DAS was only 0.48. Improvement on the relationship of grain yield and NDVI/DAS was made when the data were further grouped by climate regime, i.e. temperate (r^2 = 0.53) versus sub-tropical (r^2 = 0.63). In two out of four sites, variably applying midseason N to rice based on sensor readings resulted in a 10 and 48 kg N/ha reduction in applied N, which translated into 15% and 5% higher NUE compared with the standard N rate recommendation. The sensor-based N tool recommended 12 and 7 kg N/ha higher than the standard N rate for the other two sites and resulted in higher grain yield and similar NUE values compared with the standard N rate. The NDVI readings collected using the nadir sensor head position, in general, consistently obtained good relationships with biomass at panicle differentiation (PD) and 50% heading when compared with tilted or twisted sensor head orientations.

Our findings suggest that a yield potential predictive model for rice will be established from NDVI readings that will be collected using the nadir sensor head orientation. *LA-23*

Kentucky

Evaluation of Sidedress Nitrogen Sources in Dark Tobacco

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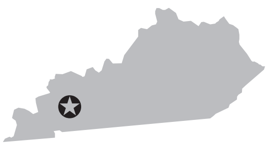

Research was conducted in 2010 at the West Farm of Murray State University to evaluate the effect of several sidedress N sources on crop vigor, yield, and quality grade index of dark fire-cured tobacco. The site was a Grenada silt loam with soil test P index of 56 (medium), soil test K index of 175 (low), and pH 6.1. One ton/A agricultural lime was applied and disk-incorporated in early spring and 150 lb N/A, 100 lb P_2O_5/A, and 220 lb K_2O/A were broadcast and incorporated to the entire area on June 7, one week prior to transplanting 'PD7318LC' dark tobacco on June 15. All other production practices followed standard recommendations. Weather conditions during the 2010 season were wet early in the season with hot/dry conditions occurring after June 15, just after transplanting and continuing for much of the remainder of the season. Sidedress N applications were made on July 9 at 150 lb N/A. Seven N source treatments were used in the trial and included no sidedress (150 lb N/A pre-transplant only), Sulf-N 26 ammonium sulfate nitrate, a 50:50 blend of Sulf-N ammonium sulfate:urea, ammonium nitrate, UAN-32 liquid, UCAN-21 liquid (CN-9 + UAN-28), and potassium nitrate.

Mid-season crop vigor was evaluated in late July with no growth differences observed among N sources. Dark fire-cured tobacco total yields ranged from 2,609 to 3,130 lb/A with no statistical differences among N sources. There were some differences in the leaf grade only, with highest leaf yield coming from the ammonium nitrate treatment and lowest leaf yield coming from the UAN-32 treatment. There were also minor differences in quality grade index between treatments, with highest grade index occurring with the Sulf-N 26 ammonium sulfate nitrate treatment and lowest grade index occurring in the potassium nitrate treatment. *KY-10F*

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

The development of a more profitable and environmentally-sound production system is essential to grain 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 USA. Nitrogen fertilizer is one of the major agricultural inputs and is considered as the most expensive plant nutrient in rice production. This project was continued in 2010 to: 1) update the working algorithm of the proposed sensor-based N decision tool for estimating mid-season N requirement of rice; 2) evaluate the performance of the 2009 sensor-based N decision tool; and 3) address the issue on water reflectance interference on sensor readings. Sensor readings were collected from seven variety x N trials established in Louisiana and Mississippi once a week for five consecutive weeks starting at panicle initiation.

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Our findings suggest that a yield potential predictive model for rice will be established from NDVI readings that will be collected using the nadir sensor head orientation. *MS-16*

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

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Project Cooperator: Jack Varco

Switchgrass grown as a biofuel crop has been shown to have a significant response to N applications in poor quality soils during the early years of its production. An N response study was conducted at Mississippi State University over the past 1.5 years. Data collected thus far indicate that switchgrass total N concentration declines in late summer because of translocation of aboveground N to the nutrient reserve below ground (roots and crown).

Radio labeled ^{15}N was used to test the hypothesis that well-established switchgrass depends more on an internal nutrient translocation system than on the uptake of applied N. A linear increase in seasonal yields was observed, but no significant mean separations were observed in 2009 or 2010. Average yields indicated a 20% and 30% increase for the 56 and 112 kg N/ha application rates when compared to the control. Shoot and root samples are being analyzed for ^{15}N, C, P, and K. The amount of total N removed from the system was directly related to biomass yield, and was significantly affected by harvest time and biomass component (shoot, crown, and roots). Importantly, there were no significant changes in N content between an early winter harvest (November) and a late winter harvest (February). The below-ground canopy at 15 cm depth indicated that 63% of the biomass was allocated to crowns while 37% was allocated to roots. A significant below ground biomass type x date interaction was observed in the percent of biomass distribution. Crowns had a higher N (64 g/m^3) content that roots (37 g/m^3). Nitrogen content was also affected by sampling date and N rate. Significant changes in N concentrations were observed between aboveground biomass and below ground constituents across sampling date, but no significant differences were observed between crown and root. Nitrogen concentration was affected by N rates in both above- and below-ground biomass. Nitrogen concentration fluctuated over the sampling dates with higher concentrations towards the beginning of the growing season, which declined at the end of the season.

This study indicates that N translocation occurs soon after senescence and thus there is no reason to risk yield losses by delaying harvest over the winter. *MS-17*

South Carolina

Incorporating Soil Electric 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 from 2008 to 2010 at the Pee Dee Research and Education Center located near Florence, South Carolina. The objective was to evaluate optical sensing technology to predict sidedress N requirement under different tillage systems and soil electrical conductivity (EC) zones. In 2009, the predicted sidedress N application of 40 lb was sufficient, compared to a standard N application of 80 lb N/A. In 2010, predicted sidedress rate of 120 lb N/A increased corn yield by about 10 bu/A compared to the standard sidedress N application. Comparing tillage systems, significantly higher corn yields were obtained from strip-till than no-till and conventional tillage in 2008, whereas higher yields were recorded from conventional than no-till in 2009. Corn yields significantly increased with N application of up to 80 lb/A in 2008, but there was no significant yield increase with increasing N rates from 0 to 120 lb N/A in 2009, mainly due to drought conditions. Due to relatively higher moisture and nutrient holding capacity, significantly higher grain yields were observed in soil EC zone 3 (highest EC) in 2008, and zones 2 and 3 in 2009 compared to zone 1. In 2010, further evaluation of N applications under different soil EC zones showed a quadratic response of N application on corn yield under soil zone 1 and linear responses under zones 2 and 3. Predicted sidedress N rates at V6 based on optical sensing technology showed that a calculated sidedress rate of 30 lb N/A was adequate for zone 1 and 60 lb N/A (rate 25% lower than the calculated average across zones) was sufficient for soil zones 2 and 3.

These results indicate that the predicted sidedress N for the sandiest area of the field may have to be evaluated separately for N applications from the field average. As for the soils with higher soil EC, 25% lower N rate than the predicted rate of 80 lb N/A based on the algorithm may be sufficient without significant yield reductions. Optical sensing technology can be successfully used to help growers improve profitability by optimizing N application rates. The sidedress N recommendations should account for soil EC zones to improve N use efficiency for dryland corn and reduce nitrate leaching potential. *SC-14* ■

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