IPNI INSIGHTS
INTERNATIONAL PLANT NUTRITION INSTITUTE

September 2012

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 Fertilizer Application Uniformity and Nutrient Distribution

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Project Cooperators: Charles Wood and Greg Pate

Blended fertilizers are commonly applied to crop and pasture land using spinner-disc spreaders. However, the nature of blended fertilizers can make it difficult to spread uniformly due to varying physical properties of the different granules, which can lead to segregation during application. Further, variable-rate application of blended fertilizer could pose challenges in terms of accuracy and uniformity to meet target prescription rates. Therefore, a study was conducted with the primary objective of evaluating the potential of fertilizer segregation during application with a spinner-disc spreader. A series of standard pan and field tests were performed to evaluate mass and nutrient distribution for a blended fertilizer product (17-17-17). Spreader calibration was conducted prior to data collection according to manufacturer specifications. After calibration, replicated standard pan testing was conducted to measure both distribution based on mass and nutrient (N, P_2O_5 and K_2O) concentration across the spread width. Field tests consisted of generating fertilizer prescription maps followed by a variable-rate application using 17-17-17. Collection pans were randomly placed across the field and fertilizer collected in each pan was weighed to determine the actual rate applied and analyzed for nutrient concentration. Field data, prescription, and as-applied maps were used to evaluate performance and product segregation.

Results indicated that P and K concentrations (CV 25% and 26%, respectively) varied significantly across the swath and in the field indicating the occurrence of fertilizer segregation. Nitrogen concentration remained uniform across the swath during both pan tests (CV=4%) and during field application (CV<8.5%). Particle size difference between the individual fertilizer constituents was the primary reason for segregation. The segregation of fertilizer particles resulted in under-application of P, but under- and over-application of K during field application. Of note, this study represents results for one spreader setup and a single blended product and may not reflect possible performance for a different setup, spreader, and other blended products. A more detailed study is planned for 2012 to gain insight into understanding blended formula segregation applied with modern spinner spreaders. *AL-19*

Arkansas

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

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Field studies were conducted for the third year on switchgrass yield response to N fertilizer in northwest Arkansas. Another study evaluating N, P, and K fertilizer response was established in eastern Arkansas in 2011 and switchgrass variety trials were conducted in 2010 and 2011. For the N, P, and K fertilizer trials, average forage yield was 7 ton/A. The fertilizer nutrients were tested in physically separate trials, which were adjacent to each other. In the N rate trial, N concentration increased,

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Notes and Abbreviations: N = nitrogen; P = phosphorus; K = potassium; Mg = magnesium; Ca = calcium; S = sulfur.

P concentrations were unaffected, and K concentrations declined with increments of N fertilizer. In the P trial, no elemental concentrations were affected by P fertilizer rates. In the K trial, there was a slight, nonsignificant trend for an increase in K concentration with K fertilizer increments, whereas N and P were unaffected. The N rate study in 2011 showed a significant increase in biomass yield with increments of fertilizer applied as urea in one application in early May. The trend in response was linear from 0 to 90 lb N/A, then leveled off at the highest increment. This was similar response to that found in 2010. Yields were lower in 2011 than in 2010 because of record high summer temperatures and a prolonged drought. Concentrations and removal rates of N, P, and K are still being analyzed.

The variety trials compare advanced breeding lines 'Cimarron', 'C75', and 'C77' with the standard, commercially available cultivar, 'Alamo'. All plots received 60 lb N/A in late April each year. At the beginning of 2011, the plot area was found to have low soil test values for P and K. Therefore, 60 and 115 lb/A of P_2O_5 and K_2O, respectively, were applied to the plot area. Cimarron, a new release, exhibited greater biomass yield than Alamo. New, high-yielding cultivars of switchgrass would be expected to remove more N, P, and K from the field than Alamo. The added P and K fertilizer probably explains most of the increase in biomass yield in 2011 compared to 2010; however, somewhat more favorable rainfall in 2011 may explain some of the increase. Although not designed as a fertilizer response study, the results suggest that switchgrass does respond to P or K, with K being the more likely limiting nutrient, as indicated by the increased K tissue concentrations in the K fertilizer trial described above. *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, increasing input costs 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 a Basinger fine sand (siliceous, hyperthermic Spodic Psammaquents). The study was conducted at the Range Cattle Research and Education Center in Ona, FL during May to November, 2011.

Because of lack of rainfall in 2011, bahiagrass yields were significantly reduced as compared to previous years. Nitrogen sources increased cumulative bahiagrass dry matter yield by approximately 65% compared to 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 = 8.8%) and the treatments receiving 50 lb N/A (CP = 9.8%). However, application of 100 lb N/A resulted in higher CP concentrations (CP = 10.7%). Soil extractable inorganic N concentrations and soil pH at the 0 to 6 and 6 to 12-in depth were not affected by N fertilizer application. *FL-29F*

Nitrogen Rate Study for Potato Production in Northeast Florida

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Project Cooperator: Daniel Cantliffe

With approximately 25,000 acres of winter and spring potatoes, Florida is an integral part of the supply chain for freshly harvested potatoes in the United States. Fertilizer BMPs are being developed to increase N-use efficiency for potato production and to reduce N-leaching. This ongoing study aims to determine optimal N-rates for commercial potato production. This study was performed with grower collaboration in six seepage-irrigated locations throughout northeast Florida, with three locations growing potato variety 'Atlantic,' and three growing 'FL 1867.' Nitrogen fertilizer rates ranged from 100 to 300 lb N/A as ammonium nitrate. All plots received 50 lb N/A of N at fumigation; N was then sidedressed twice with the plots receiving 0, 50, 100, or 150 lb N/A at emergence then 50 or 100 lb N/A at the 6 to 8-in growth stage. Total and marketable yield, specific gravity, plant dry weights, and N levels in the plants (tubers, leaves, and stems) were evaluated. Soil N levels were recorded throughout the season. Nitrogen content in the soil and N uptake into the plant were monitored throughout the season and potato yields were compared among treatments.

No difference in potato yields was observed among N rate treatments for Atlantic at any location. The Atlantic variety accumulated about 90 to 140 lb of N/A in the tissues (leaves, stem, and tubers). Atlantic total yield ranged between 200 and 290 cwt/A and N fertilizer rates above 230 lb N/A did not increase total yields. FL1867 was more responsive to N fertilization and highest yields were obtained when 100 to 150 lb N/A was applied at emergence in two of the three locations. For FL1867, total yields ranged from 350 to 395 cwt/A. For both varieties, the N accumulated by potato plants ranged from 130 to 190 lb N/A. The residual soil nitrate after harvest tended to increase according to N fertilizer rate. N fertilizer rates above 200 lb N/A left 60 to 120 lb N/A in the soil following harvest. The preplant N application did not increase soil N availability at plant emergence. Reduced soil N content coincided with heavy rainfall events. More research is needed to confirm these initial results. *FL-30*

Louisiana

Validation of an On-Site, Active Sensor-Based Midseason Nitrogen Decision Tool for Rice Production in the Mid-South

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Project Cooperators: Dustin Harrell, Timothy Walker, Yumiko Kanke, and Josh Lofton

Nitrogen is the most limiting and expensive plant nutrient in rice production. A need-based application of N fertilizer plays an important role in developing a more profitable and environmentally-sound rice production system in the Mid-South. Three years of optical sensor and rice yield data were collected and used to establish the working algorithm that runs a sensor-based N decision tool (SBN tool) that was used for determination of topdress N application rates for rice in 2011. Validation studies for the SBN tool were conducted at three sites in Louisiana and Mississippi using three rice varieties (CL152, CL162, and CL261). Different rates of N fertilizer applied either one time at preflood or split between preflood and midseason were arranged in a randomized complete block design with four replications. Two additional treatments, 75 and 105 lb N/A preflood N followed by a topdress N rate based on the SBN tool recommendation, were also included.

All sites were responsive to N fertilization except Rayville in Louisiana. Highest grain yield response was obtained from rice grown in Crowley (107% increase in grain yield). There were no significant differences in yield, N uptake, N use efficiency, and net return between plots which received SBN N rate recommendations and predetermined split N rates (75-45 or 105-45 lb N/A). However, topdress rate recommendations using the SBN decision tool ranged between 32 to 45 lb N/A and 21 to 28 lb N/A for Louisiana and Mississippi sites, respectively. Results showed that the SBN decision tool performed better than predetermined N rates using NUE and net return to N as performance indicators. Future work will include attempts to refine the working algorithm by considering the use of a single yield potential predictive equation for both Louisiana and Mississippi, and economic parameters (cost of rough rice and N fertilizer). *LA-24*

Missouri

Survey of Weed Nutrient Removal Potential in Missouri Soybean

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With the increasing adoption of glyphosate-resistant crops, concern for the timeliness of herbicide applications has declined and in many cases herbicide applications are made to large weeds that have already resulted in yield loss. With this in mind, a survey was conducted in 2011 to monitor 32 soybean fields in Missouri. The objectives of this survey were: 1) to determine the most common weeds encountered in soybean fields in Missouri, 2) to determine the average size and density of weeds present at the time of the post-emergence herbicide application, and 3) to determine the impact of typical weed infestation levels on nutrient removal. Observations were made once every two weeks from soybean planting through canopy closure in each of the survey locations. Just prior to the time of the post-emergence (POST) herbicide applications, sub-samples of weeds present at each location were harvested and analyzed for nutrient content.

At the time of the first POST herbicide application, all broadleaf weeds other than waterhemp were present at an average density of 1 plant/ft^2. The average height of broadleaf weeds other than waterhemp and all grass weeds present at the time of the first POST herbicide application were 7.5 to 10.5-in, respectively. Waterhemp was encountered at an average density of 2 plants/ft^2 and average height of 8.5-in at the time of the first POST herbicide application. Estimated soybean yield losses based on the weed densities and height of weed present ranged from 0 to 8 bu/A, with an average yield loss of 2.5 bu/A occurring across the 32 surveyed locations. Based on the weed densities present in the survey locations, the average amount of N, P, and K weed removal in soybean fields in Missouri was 3.2, 0.4, and 3.7 lb/A, respectively. The weed infestations encountered also resulted in an average removal of 0.7 lb of Mg, 2 lb of Ca, and 0.3 lb S per acre. To date, these first-year results indicate that yield loss is likely occurring in the majority of soybean production fields in Missouri as a consequence of waiting too long to control broadleaf and grass weed species, and that at least some portion of this yield loss can be attributed to weed nutrient removal. *MO-34*

North Carolina

Soil Fertility Management for High Population, Narrow Row Corn Production

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Project Cooperators: Ronald Gehl, Alan Meijer, and Ronnie Heiniger

The objectives of this research were to determine the optimum N timing and rate in high population, narrow row corn production systems. A series of 11 N fertilizer response experiments were conducted on Tidewater, Coastal Plain, Piedmont, and Mountain (grain and silage) region sites in North Carolina during 2010 and 2011. Corn yield response and yield components (# rows per ear, # kernels per row, and kernel size) were compared among wide row (30- to 40-in) and narrow row (15-to 20-in) corn that was fertilized with N either all at planting, or with both starter fertilizer (limited to 5 gpa 11-37-0) and sidedress N (between V5 and V8 stage). The starter band application of 6 lb N/A was applied to all plots in all experiments to insure rapid early season growth, except for one site to which 50 lb N/A had been applied uniformly in a granular pre-plant broadcast blended fertilizer. These data document general principles of N-use efficiency associated with different corn row widths and N application timing.

On average, approximately 0.7 lb N/bu was required to achieve optimum corn yield levels at these sites. In most cases yields did not differ due to N timing or corn row width. Nevertheless, when significant differences were noted, sidedress N applications resulted in higher yields compared with applying all N at planting, and narrow row planting

resulted in higher grain yield than wide row planting. Data also suggest that corn plants experience more N limitations during late season periods, since changes due to N rates were detected in later-determined ear yield components, rather than plant and ear density components. The average number of rows per ear increased by a relatively small amount, from 15.9 to 16.4; while relatively greater increases were observed in row length, from 27 to 32 seeds per row, and seed weight, from 222 to 252 mg per seed. This could direct future management research into methods to ensure later season N sufficiency. *NC-21*

Kentucky

Evaluation of Sidedress Nitrogen Sources in Dark Tobacco

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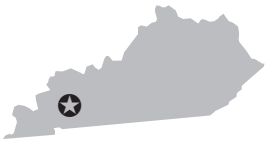

Research was conducted in 2011 to evaluate the effect of several sidedress N sources on crop vigor, yield, and quality grade index of dark fire-cured tobacco. The site had a soil test P index of 62 (high), soil test K index of 216 (medium), and pH 6.2. One ton/A agricultural lime was applied and disk incorporated in early spring and 150 lb N/A (urea/DAP), 80 lb P_2O_5/A (DAP), and 180 lb K_2O/A (potassium sulfate) was broadcast and incorporated to the entire area on June 6, one week prior to transplanting 'PD7309LC'dark tobacco on June 14. Treatments were arranged in a randomized complete block design with 4 replications and individual plots were 4 rows by 40 ft long. Non-fertility practices followed standard production guidelines. Weather conditions during the 2011 season were wet prior to transplanting in April and May, with hot temperatures but adequate moisture during the growing season, and ample moisture during the curing season. Ambient rainfall was supplemented with drip irrigation in this trial. Sidedress N applications were made on July 22 at 150 lb N/A and immediately incorporated. Seven sidedress N source treatments were in the trial and included no sidedress (150 lb N/A pre-transplant only), Sulf-N 26 ammonium sulfate nitrate, 50:50 blend of Sulf-N ammonium sulfate and urea, ammonium nitrate, UAN-32 liquid, UCAN-17 liquid (CN-9 + UAN-28), and potassium nitrate. Crop vigor was evaluated in late August with the best crop vigor occurring from tobacco treated with potassium nitrate and lowest crop vigor in tobacco that received no sidedress N. Tobacco was manually stalk harvested in early October, housed in a traditional dark-fired barn, and fired four times with hardwood slabs/sawdust as is standard. Tobacco was taken down and stripped into 3 stalk positions (lug, second, leaf) in early December.

There were slight differences in the lug position yield, with lugs produced from tobacco treated with ammonium nitrate weighing slightly more than lugs produced from tobacco receiving no sidedress N or UCAN-17. Total dark fire-cured tobacco yield ranged from 3,441 to 3,642 lb/A with no statistical differences among N treatments. There were differences in quality grade index between treatments, with the highest grade index occurring in tobacco receiving the 50:50 blend of Sulf-N ammonium sulfate and urea (56.8), and the lowest grade index occurring in tobacco receiving no sidedress N or UCAN-17 (30.6 to 31.2). *KY-10F*

Evaluation of Sidedress Nitrogen Sources in Burley Tobacco

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Various N fertilizer sources were evaluated for use in burley tobacco production during the summer of 2011. The materials tested included ammonium nitrate (34-0-0), calcium-ammonium nitrate (27-0-0), urea (46-0-0), and Sulf-N 26 ammonium sulfate nitrate (26-0-0-14S). An extremely wet spring at this location delayed planting until after the first of June. The field was prepared as is typical for burley tobacco production and a base rate of 50 lb N/A was applied in the form of urea. Burley tobacco (var. KT-209) was transplanted into the field on June 3.

At four weeks after transplanting, the sidedress N materials were applied at two rates (100 and 200 lb N/A). The field sustained moderate wind damage just prior to topping on August 11. The crop was harvested on September 12 and hung in curing barns. The wet start and wind damage tended to have a leveling effect across treatments. There was an effect of sidedress fertilizer to raise yield above the level of the 0-N sidedress check; however, all of the sidedress N materials performed similarly. *KY-11F*

Tennessee

Documenting Nutrient Deficiency and Accumulation Rate in Vegetables

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A photo catalog of nutrient deficiency symptoms is being developed for common vegetable crops. The first phase of this research and education project is to induce mineral deficiency symptoms for various hydroponically grown plants in the greenhouse. Using purified nutrient solutions, plants were systematically deprived of each essential nutrient to observe the development of deficiency symptoms.

A complete set of deficiency photographs is now available for lettuce. Photographs for spinach deficiencies will shortly be available. Peppers and eggplant will be grown to produce deficiency symptoms and tissue samples throughout the growing season will be analyzed to determine nutrient accumulation rates. A project to determine a suitable solid phase media for this research was conducted so that root system deficiencies could be measured. Perlite contained sufficient trace concentrations of nutrients to mask some symptoms even after it was washed with acid.

A blueberry experiment was conducted to examine the impact of nitrate (NO_3) or ammonium (NH_4) nutrition on plant growth and root development. Blueberry shoot and root growth virtually ceased when nitrate was the sole source of N nutrition. A portion of the rootzone N must be in the NH_4 form for blueberries to grow. All the images of nutrient deficiencies will be available for educational use from IPNI as the project progresses. *TN-20* ■