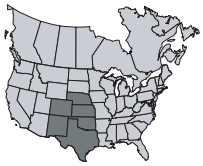
IPNI INSIGHTS
INTERNATIONAL PLANT NUTRITION INSTITUTE

Southern and Central Great Plains Region Research Report



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CONTINUING investigation into new technologies and improved efficiency is vital to any industry. Accordingly, IPNI continues a tradition of supporting agronomic research for the future of our industry.

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

Colorado

Contribution of Animal Feeding Operations and Synthetic Fertilizers to Ammonia Deposition in Rocky Mountain National Park

Project Leader: Jessica Davis, Colorado State University, Department of Soil and Crop Sciences, C06 Plant Sciences Building, Fort Collins, CO 80523. E-mail: jessica.davis@colostate.edu

Project Cooperators: Thomas Borch and Jeffrey L. Collett, Jr.

Ammonia (NH_3) deposition has been identified as a concern from both human health and environmental standpoints, and has recently been targeted by Colorado as a primary contributor to atmospheric and ecosystem changes in Rocky Mountain National Park (RMNP). The Colorado Department of Public Health and Environment has estimated that 60% of the NH_3 deposition in RMNP comes from agricultural activities with 40% from animal feeding operations and 20% from fertilizer. However, these estimates have not been verified by scientific measurement, and verification is especially important if future regulations require that agriculture be held accountable for NH_3-related ecosystem damage. One promising way to track N to its original source is via N isotopic signatures ($\sigma^{15}N$) since the ratio between the ^{14}N and ^{15}N isotopes is influenced by source. A major goal of this project is to assess the ability of isotopes as tracers, and in turn to determine sources of NH_3 contributing to N deposition in RMNP. The original objectives of this study were to 1) determine the major sources of NH_3 deposition in RMNP based on N isotopic signatures of different NH_3 sources (i.e., agricultural, natural, and industrial), and 2) quantify the relative contribution of NH_3 to RMNP from animal feeding operations, synthetic fertilizers, and other sources.

Progress over the past year includes completion of an NH_3 field sampling (radiellos) campaign, collection of wet deposition in RMNP, and a RMNP soil emission study. Radiellos were placed at seven sites including animal husbandry, urbanized sources, cropland, foothills, and RMNP. Animal husbandry had the highest average NH_3 concentrations, ranging from 4 to 100 times higher than other sources. Preliminary analysis of N isotopes has shown some variation across studied sources. Wet deposition is similar to previous studies with 1.39 and 2.00 kg N/ha during the spring and summer, respectively. Ammonia contributed 50% and 30% to total N during the spring and summer period, respectively. The findings from the RMNP show that grassland soils have higher NH_3 emissions than forest soils. Support for this work will continue in 2012. *CO-13F*

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Kansas

Effect of Long-term Nitrogen, Phosphorus, and Potassium Fertilization of Irrigated Corn and Grain Sorghum

Project Leader: Alan Schlegel, Kansas State University Southwest Kansas Research and Extension Center, Tribune, KS. E-mail: schlegel@ksu.edu

This long-term western Kansas study was initiated in 1961 to evaluate responses of irrigated continuous corn and grain sorghum to N, P, and K fertilization. Furrow irrigation was used through 2000, and sprinkler irrigation since 2001. No yield benefit to corn from K fertilization was observed in the first 30 years and soil K levels remained high, thus the K treatment in the corn study was discontinued in 1992 and replaced with a higher P rate. Nitrogen treatments for corn and grain sorghum were 0, 40, 80, 120,

160, and 200 lb N/A. Phosphorus treatments for corn and grain sorghum were 0, 40, and 80 lb P_2O_5/A, and 0 and 40 lb P_2O_5/A, respectively. The K treatments for grain sorghum were 0 and 40 lb K_2O/A.

Corn yield was above average in 2011, with maximum yield at about 230 bu/A. Nitrogen applied alone increased corn yield by 87 bu/A, while N and P applied together increased yield up to 139 bu/A. This is similar to the past 10 years where N and P applied together increased irrigated corn yield by about 130 bu/A. Application of 120 lb N/A (with P) was sufficient to produce 95% of maximum yield in 2011. Nitrogen fertilizer alone increased sorghum yield by about 50 bu/A, while N plus P increased yield by up to 75 bu/A. Application of 40 lb N/A (with P) was sufficient to produce about 80% of maximum yield in 2011. Potassium fertilization had no effect on sorghum yield. This is one of the few continuous, long-term crop nutrition studies in the U.S., and support is planned to continue in 2012. *KS-23F*

Effect of Potassium, Chloride, and Nitrogen on Corn, Wheat, and Double-crop Sunflower Grown on Southeastern Kansas Claypan Soil

Project Leader: Daniel Sweeney, Kansas State University Southeast Agricultural Research Center, Parsons, KS. E-mail: dsweeney@oznet.ksu.edu

Project Cooperators: Douglas J. Jardine and Kenneth W. Kelley

Corn acreage has been increasing in southeastern Kansas in recent years because of the introduction of short-season cultivars which enable producers to partially avoid mid-summer droughts that are often severe on the upland, claypan soils of the area. Also, producing a crop after wheat and in rotation with corn may provide producers additional revenue by growing three crops in two years. Recent interest and developments in oil-type sunflower provide an alternative to soybeans for growers to double-crop after wheat. The objective of this project is to determine the effect of N, K, and Cl^- fertilization on yield, yield components, and nutrient uptake of short-season corn, wheat, and double-crop sunflower grown in a 2-year rotation on a south eastern Kansas claypan soil.

Wheat yield, yield components, and leaf rust disease ratings were unaffected by K or Cl^- fertilization in 2011. Increasing N rate from 0 to 120 lb/A increased wheat yield, heads/A, and dry matter production at the soft dough stage, but slightly decreased seed weight. Average yield of double-crop sunflower following wheat in 2011 was low at 650 lb/A, likely because of unusually hot and dry conditions. Sunflower yields were unaffected by K, Cl^-, N, or their interactions, even though K and N fertilization increased the number of seeds per head. Potassium fertilization increased dry matter production at the R1 growth stage. Approximately 50% of the sunflower heads were affected by Rhizopus head rot, but disease incidence was not statistically affected by fertilizer treatments. This study was initiated in 2010, and since crop response to fertilizer treatments has been marginal over the first cycle of this 2-year rotation, the work will not be continued. *KS-40*

Applied Fertility Management for Irrigated Soybean Production

Project Leader: J. Randall Nelson, Kansas State University Department of Agronomy, Courtland, KS. E-mail: jrnelson@ksu.edu

Irrigated soybean yields in North Central Kansas averaged about 53 bu/A over a recent 10-year period from 2000 to 2009. Although yields have trended upward, producers in the area are largely unsatisfied. Past research conducted at the Kansas State University North Central Kansas Experiment Field near Scandia has demonstrated that proper fertility management, including direct application of P and K, has the potential to significantly improve irrigated soybean yield. Despite the findings of this work soybean producers have been slow to adopt intensive fertility management programs. It has been speculated that adoption might be facilitated if these results were demonstrated on farmer fields outside the experiment station. The purpose of this research is to expand upon previous high-yield soybean work by including a field scale, farmer-cooperative component to increase awareness of irrigated soybean yield potential with proper fertility management.

This project will consist of a combination of small fertilizer response plots conducted at the KSU Irrigation Experiment Field and a field scale study on a producer's field. Small plot treatments will include a zero fertilizer control, and all combinations of 30 and 80 lb P_2O_5/A, and 80 and 120 lb K_2O/A. The effects of N and S will also be evaluated at the higher P and K rates. Field scale plots will be simpler, with one P (30 lb P_2O_5) and one K (80 lb K_2O) rate a combination of the two. This work was planned and cooperation established in late 2011, so results are not yet available. The first year of production will be 2012, and the project is expected to continue for three years. *KS-41*

Nebraska

Soil Test Phosphorus Level and Yield Potential

Project Leader: Charles Wortmann, University of Nebraska-Lincoln, Lincoln, NE. E-mail: cwortmann2@unl.edu

Project Cooperator: Tim Shaver

This University of Nebraska-Lincoln project is designed to test whether maintaining high soil P availability is important to corn yield in enough years to justify the cost of building and maintaining high levels of soil P. The research, started in 2011, is being conducted at the Haskell Agricultural Laboratory (HAL), the Agricultural Research and Development Center (ARDC), and the West Central Research and Development Center (WCREC) in Nebraska. The sites have a history of conservation tillage. The HAL site is rainfed and the others are irrigated.

The effect of five P treatments on yield of irrigated continuous corn is being compared under no-till and disk till conditions at all sites. Initial soil Bray1-P level was less than 15 ppm at all sites. The P treatments are: 1) Bray1-P of <15 ppm - no P applied; 2) P applied according to the UNL recommendation; 3) Bray1-P raised and maintained at 25

ppm; 4) Bray1-P raised and maintained at 35 ppm; and 5) P applied based on removal. Phosphorus was applied before planting and tillage in the spring of 2011 assuming 12 lb P_2O_5 was needed to raise Bray-1 P 1 ppm. Zinc was applied to minimize the chance of P induced Zn deficiency. Trials have four replications.

Corn yield in 2011 at the ARDC was less than expected, probably because of high night temperatures in July. Also, there was no consistent response to applied P at ARDC, which may have been due to relatively high deep soil test P; however, early growth and early P uptake were increased with P application. Yield was consistently less with no P applied compared with other treatments at HAL and WCREC. This is the first of a five year study, so substantive conclusions cannot yet be made. Support will continue in 2012. *NE-14*

Texas

Nutrient Removal by Fruit and Vegetable Crops in Texas

Project Leader: John Jifon, Texas A&M Texas AgriLife Research & Extension Center, Weslaco, TX. E-mail: jljifon@ag.tamu.edu

A balance between nutrient inputs and crop removal is required for effective long-term crop production. Although nutrient removal estimates are readily available for many field crops, such values for fruit and vegetable crops are rare. The objective of this project is to determine nutrient removal values for major fruits and vegetable crops grown in South Texas, and to use the information to help refine fertilizer recommendations for yield and quality.

During the spring growing season of 2011, nutrient removal amounts were estimated for muskmelons and onions from fields that were previously investigated in 2009. Removal rates by grapefruits from commercial orchards were also estimated (2011 only). Average melon yield in 2011 was 19.8 tons/A with nutrient removal averaging 92 lb N/A, 18 lb P/A, and 121 lb K/A. Sweet onion bulb yields in 2011 averaged 13.8 tons/A with average nutrient removal of 61, 19, 75 lb/A for N, P, and K, respectively. Grapefruit yields averaged 12.2 ton/A fresh fruit and nutrient removal averaged 29 lb N/A, 8 lb P/A, and 66 lbs K/A.

Continued sampling over multiple years and locations with varying weather conditions, soil types and yield scenarios will be needed to establish realistic nutrient removal values that can be used to develop improved fertilizer management guidelines. Support for this work will continue in 2012. *TX-55* ■

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Nutrient Deficiency Photo Application for iPhone/iPad Released

IPNI has released a new Crop Nutrient Deficiency Photo Library app for your iPhone or iPad (see http://info.ipni.net/ndapp). The app contains key photos of classic nutrient deficiency documented from research plots and farm fields for 14 common crops. It also provides supporting text and illustrations of nutrient deficiencies. This mobile app will be a great tool for crop advisers, consultants, farmers, and anyone wanting help in identifying nutrient deficiency symptoms in common crops. BC