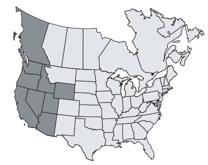
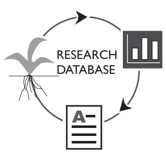
INSIGHTS
IPNI International Plant Nutrition Institute
September 2012



Western Region Research Update

Research to Maintain Competitiveness

In this tough economic environment, everyone is looking for better and more efficient ways of doing things. Agricultural productivity in Western North America is already amongst the highest and most intensive in the world, but we are always being pressed to squeeze out more profitability in a sustainable way, in the face of tough global competition.

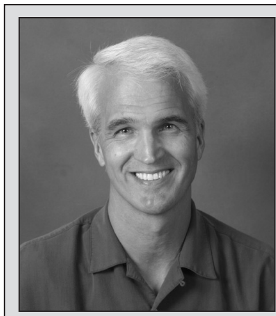


IPNI has been a leader in reminding farmers that using the "4R" concept for nutrient stewardship (Right Source, Right Rate, Right Time, and Right Place) can lead to significant economic, environmental, and social benefits.

While the 4R approach is really nothing new for most experienced farmers, it provides a systematic way to reevaluate traditions and routine management decisions that may be due for a change. We cannot always be satisfied with doing things they way they have been done in the past.

Supporting agronomic research is central to the mission of IPNI to "provide responsible management of plant nutrients for the benefit of the human family". We are fortunate to be able to partner with leading researchers to investigate better ways of using plant nutrients in the most appropriate way.

This issue of INSIGHTS features a brief summary of some of the research projects supported by IPNI in Western North America, but it is only a small fraction of the research projects that IPNI supports worldwide. Further information on these and other global research projects supported by IPNI can be found at the research database of our website: >**ipni.net/research**<.



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Arizona

Improving Nitrogen Fertilizer Management in Surface-Irrigated Cotton

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Project Cooperator: Pedro Andrade-Sanchez, Doug Hunsaker, and Eduardo Bautista

The first year of this project was devoted to comparing N sources for furrow-irrigated cotton, developing a tool for predicting N fertilizer response using canopy reflectance-based N management in surface-irrigated cotton, and constructing a N balance for surface-irrigated cotton (quantify total N uptake, recovery N use efficiency, NO_3 leaching, and denitrification losses).

High pre-plant soil NO_3 precluded yield response to N this year.

We did collect valuable sets of canopy reflectance/vegetative indices. The total N uptake data at first open boll resulted in valuable internal N use efficiency data (67 lb N/bale). The nitrous oxide emission data was high quality data, some of the first of its kind. Nitrous oxide emissions were barely detectable in all N treatments during the 56-day measurement period following fertilization and fertigation, with the exception of the fertigation treatment. That treatment lost 0.9% of fertigated N as N_2O, which is in the range of N_2O losses measured from drip-irrigated cotton in Texas.

Amber NDVI (amber being 590 nm) using 820 nm had less up or down noise than the other indices. Calculating NDVI with a red edge (i.e. 730 nm) of NIR reportedly has the advantage of not saturating at high leaf area levels. Amber NDVI using 820 nm had the highest correlation among the indices with in-season biomass and N uptake. *AZ-08*

California

Assessment of Alfalfa Yield Monitoring Technology to Improve Nutrient Use Efficiency

Project Leader: Andre Biscaro, University of California, Lancaster, CA. E-mail: asbiscaro@ucdavis.edu

Project Cooperator: Steve Orloff

Yield mapping has been beneficial by demonstrating the degree of yield variability in areas much smaller than whole fields. Although growers recognize this variability, it is difficult to measure and map without a yield monitor. Grain crops have led the way with yield monitoring technology. However, it is not widely used or is still under development for many other important crops. In other crops, like alfalfa, the technology has not even existed until recently. Using bale sampling and tissue testing and then noting the bale locations with a GPS, hay quality and crop nutrition status can be linked with yield data for specific locations in the field. Overall, we expect that the use of yield monitoring data can significantly increase fertilizer use efficiency by meeting specific crop needs, increase hay yield and quality, and reduce potential P and K losses.

In order to assess the accuracy of an experimental yield monitor, biomass samples were collected from three windrows and weighed during the fifth cutting of one alfalfa field, and compared with yield monitor values. Management zones were created based on the previous cutting yield maps, where high yielding and low yielding zones had been established. The comparison of biomass samples and yield monitor values consisted of comparing sections of the alfalfa windrow to the closest bale weight from the yield monitor.

Although the alfalfa yield monitor was simple to install and operate, a considerable amount of data was lost during the baling processes due to different reasons related to equipment malfunction. Of the three fields monitored, we were unable to collect whole field data for any of them for all the five cuttings during the 2011 growing season. This fact made it difficult to advance to the next step of the project: defining management zones and assess the yield monitor accuracy.

Overall, the yield maps created with the yield monitor were able to show clear differences in various parts of the fields, which were confirmed by the grower. However, the biomass weight comparison between the yield monitor and direct measurements showed an unacceptably large difference in dry yield (over 30%). Therefore, we expect to investigate the possible causes of the yield monitor's lack of accuracy during the 2012 growing season and attempt to meet the original objectives. *CA-30*

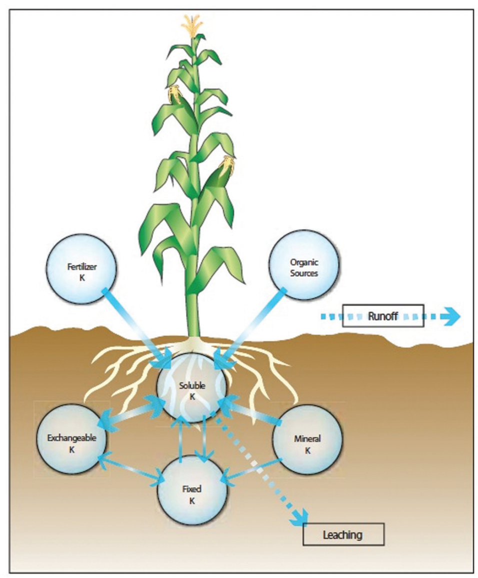
Relationship of Soil Potassium Fixation and Other Soil Properties to Fertilizer Potassium Rate Requirement

Project Leader: Stuart Pettygrove, University of California Department of Land, Air & Water Resources, Davis, CA. E-mail: gspettygrove@ucdavis.edu

Project Cooperator: Randal Southard

Potassium is an essential element in plant nutrition, and a sufficient supply of K is required to maximize crop yield. Some minerals fix K by trapping it in their interlayer region. Vermiculite is commonly found in the silt and fine sand-sized fractions of soils formed from granitic parent materials. For our current research, we selected these K-fixing soils from Central California.

Measuring levels of plant-available K can be challenging, especially in soils with high K fixation potential. Several techniques have been developed, but there is no agreement on the best way to predict the effects of K fixation. The most common laboratory method for measuring plant available K is extraction with ammonium acetate (NH_4OAc). Extraction with sodium tetraphenylboron (NaTPB) correlates closely with K uptake by plants. A new test (Kfix) was developed by Murashkina, which predicts K fixation potential.



To analyze the fate of added K, a potassium chloride (KCl) solution was added to air-dried soil at concentrations equal to the Kfix capacity. Moist soils were incubated for up to 16 days and then analyzed by the NH_4OAc and Kfix methods. The NaTPB method was not consistent for moist soils in this study. Subsamples were allowed to air-dry and extracted. Samples were subjected to four cycles of wetting and air drying after the initial application of K and analyzed after each drying cycle.

Even after adding K equal to their Kfix capacity for these soils, they continued to fix K, though at levels lower than for the untreated soils. The extracted K increased after K addition, but by amounts less than the K that had been added. Kfix was independent of the duration of incubation. Changes to the fixation potential of these soils after the addition of K all took place in the first 24 hours. For all soils, Kfix values for moist samples were lower than for their dried counterparts. Additional cycles of wetting and air drying had no discernible effect on the extractable K. Any changes that took place upon drying were not enhanced by repeating the wetting and drying process. Further development of this information will be useful in understanding the fate of fertilizer K applied to K-fixing soils, and in developing better fertilizer recommendations. *CA-31*

N_2O Emissions from the Application of Fertilizers: Source Partitioning

Project Leader: Johan Six, University of California Department of Plant Science, Davis, California. E-mail: jwsix@ucdavis.edu

Project Cooperators: Charlotte Decock and Clifford Snyder

Meta-analyis is a relatively new statistical technique for combining the findings of many independent studies to identify consistent trends from various treatments and factors. It draws on findings from many scientific reports to observe patterns among studies instead of drawing inferences from only a few studies, thereby eliminating possible errors due to the small size.

Nitrous oxide (N_2O, a potent greenhouse gas (GHG)) emission reduction protocols are being developed by various entities with different interests, several of which rely only on reductions in N (fertilizer application)rate to achieve reduced N_2O emissions. A project was initiated in late 2011 to perform a meta-analysis of the peer-reviewed published science to determine the effects of all four R's (right source, rate, time, and place of application) on N_2O emissions in corn-soybean or continuous corn systems in North America, with a focus on the U.S.-states of Iowa and Illinois. More than 100 research papers have been assembled for potential inclusion of relevant parameters in the database; including presence and amount of irrigation, soil bulk density, water-filled pore space, and changes in soil organic carbon content or CO_2 emissions where available. The database will also include class variables for N timing (fall, spring, split, side-dress, etc.), placement (surface broadcast, incorporated, banded, etc.) and N source (urea, anhydrous ammonia, ammonium nitrate, urea ammonium nitrate, etc.). The database is completed and actual meta-analyses is underway.

This work helps support the TFI-led USDA Conservation Innovation Grants (CIG) demonstration project which aims to demonstrate that Midwestern corn-soybean producers can be incentivized to adopt new fertilizer management practices that will reduce N_2O emissions, increase crop productivity and nutrient use efficiency through BMP implementation, while also generating revenue from the monetization of carbon-based GHG credits. *CA-32*

Western Nutrient Digest- A Regional Publication to Promote Nutrient Efficiency

Project Leader: Rob Mikkelsen, International Plant Nutrition Institute Western U.S. Region, Merced, CA. E-mail: rmikkelsen@ipni.net

The University of Idaho started a statewide quarterly publication in 2008 to highlight their current research in plant nutrition and fertilizer management. University funding for this publication was eliminated due to budget cuts and distribution of the Nutrient Digest ceased. New funding from IPNI has allowed this valuable electronic publication to begin again and to expand further to include ten states in the Western U.S. region. The range of topics addressed in each issue and variety of crops discussed has significantly expanded to include items of interest throughout the region. Contributing authors are solicited to write on topics that are of current interest or that reports on important new research information. As the Digest continues to become better recognized in the Western U.S., it is anticipated that future funding will come from private industry to support the publication. Past copies of the newsletter are available at: http://www.extension.uidaho.edu/nutrient/newsletter.html. *CA-00D*

Idaho

Root Scans to Document Fertilizer Response

Project Leader: Jared Williams, Brigham Young University, Rexburg, ID. E-mail: williamsj@byu.edu

Project Cooperators: Kevin Anderson and Blake Willis

This rhizotron project to monitor root growth in soil was initiated with two objectives. The first was to develop educational tools with in situ demonstrations of root growth as influenced by nutrients. The second objective was to create still images and videos of root growth that could be posted on the internet. Root systems of growing plants are observed with a flat-bed scanner buried in the soil as part of a laboratory experience for a crop physiology class. The rhizotrons have also been used to conduct undergraduate research projects.

Student's involvement in the project has been important to its success. In the class, the students design independent research projects with various crops (alfalfa, wheat, barley, corn, soybeans, and potatoes), and fertilizer treatments (rate, placement, and nutrient source). Students have posted root images and videos on websites such as Facebook and YouTube. The rhizotron has been an excellent teaching tool and has facilitated students' understanding of root growth and fertilizer response. *ID-11*

Documenting Phosphorus Efficiency for Potato Production

Project Leader: Bryan Hopkins, Brigham Young University, Provo, UT. E-mail: hopkins@byu.edu

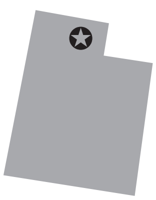
Proper P nutrition is a key component for growing high quality and high yielding potatoes. There is a need to synthesize the existing scientific information and present it in a way that can be used for improved fertilizer management. A significant body of research has now been assembled to review P fertilization practices for potatoes. These diverse reports have been synthesized into the 4R concept to deliver P in the right source and at the right rate, time, and place. A PowerPoint presentation is currently under development that will be added to the on-line library of the IPNI Crop Nutrition Series and made available for a global audience for training agronomists about potato nutrition. *ID-12*

Utah

Can Tart Cherry Yield and Fruit Quality be Increased with Improved Phosphorus and Potassium Management?

Project Leader: Grant Cardon, Utah State University Extension Soils, Logan, UT. E-mail: grant.cardon@usu.edu

Project Cooperators: Brent Black and Earl Seeley



Cherry farmers are rewarded for both high yields and excellent quality (such as fruit size, soluble solids, and acid content). Very little field research has been done on the nutritional requirements of tart cherries and their response to added fertilizer. Because trees have such large root systems and they have a large internal storage of nutrients, it often takes several years before either nutrient deficiencies or fertilizer-induced yield increases are observed. This multi-year study was designed to determine the source, rate and time of P and K application to maximize production of high quality tart cherries in Utah. Field research plots were established in 2010 on five commercial cherry orchards ranging in age from 15 to 20 years. Various rates, sources, and combinations of P and K were applied to the orchards at annual rates up to 2 lb of material per tree. Applications are made either once or twice per year.

Fruit yields exceeded 200 lb fruit/tree for many of the treatments in 2011. Since tart cherries are alternate bearing, this was a heavy fruit producing year, compared with 2010 when yields averaged only 100 lb/tree. In general, fruit yield responded positively to both P and K application, although K generally had the greatest positive effect. Splitting the applications into two annual doses did not have any yield benefit compared with a single annual application of P and K. There was some difference between the sites (with different soils and fertilization histories), but an overall positive response was measured to added P and K. In general, there was no fruit yield or quality benefits from the specialty P or K fertilizer products compared with more common fertilizer products. However, the use of potassium sulfate consistently increased the soluble solid content of the fruit. It is not clear if this is due to the K or the additional sulfur in this material.

Cherry leaf tissues are being sampled throughout the growing season to develop diagnostic criteria to allow growers to predict the need for additional nutrients. Leaf nutrient concentrations are being measured in the laboratory to correlate with fruit yield and fertilizer additions. This will allow us to provide guidance in the future to cherry farmers on when nutrients may be limiting and how much fertilizer is needed. *UT-07* ■

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