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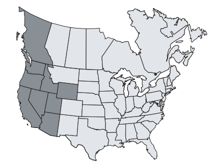
INTERNATIONAL PLANT NUTRITION INSTITUTE



September 2011

Western Region Research Update

Research to Maintain Competitiveness

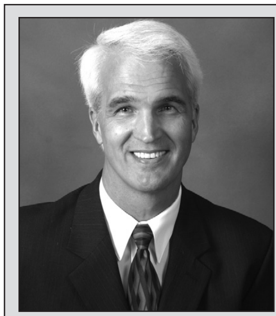
Farmers are always looking for a better way to grow their crops. Even though the agricultural productivity in Western North America is among the highest in the world, there are still things that can be done better.

A recent emphasis of IPNI has been to remind people of ways to improve nutrient stewardship. There are many economic, ecological, and social pressures that are encouraging farmers to reevaluate some of their traditional practices. In particular, better understanding of the "4R" concept for nutrients (the Right Source, Right Rate, Right Time, and Right Place) has helped growers implement management practices that may improve nutrient stewardship.

Implementing the 4R approach to fertilizer use reminds us that we cannot be satisfied with always doing things the way they have been done in the past. IPNI is pleased to partner with leading researchers to learn better ways of using valuable plant nutrients in the most appropriate way.

The reports provided here reflect only a small fraction of the research projects that IPNI supports worldwide. Supporting important agronomic research is central to our mission of responsible management of plant nutrients for the benefit of the human family.

This issue of INSIGHTS features a brief summary of some research projects supported by IPNI in Western North America. Further information on these and other global projects supported by IPNI can be found at the research database on our website: >**www.ipni.net/research**<.



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California

Sampling Technique and Maturity Effects on Nutrient Concentrations in Alfalfa

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Project Cooperator: Dan Putnam

Soil tests are effective to detect some nutrient deficiencies, but plant tissue tests are believed to be more accurate. Plant samples often better reflect nutrient availability and uptake versus soil samples. Unfortunately, most alfalfa growers do not tissue test and will fertilize based upon past practice with little idea of the actual nutrient status. Tissue testing techniques vary from state-to-state. Simplified and standardized methods of analysis could promote wider adoption of tissue testing for nutrient monitoring purposes. Currently all guidelines are based on sampling alfalfa at one-tenth bloom growth stage, but alfalfa is frequently harvested before this stage. Research was needed to compare different sampling methods and to evaluate the change in nutrient concentration with advancing maturity.

Research was conducted in five locations in Northern California to compare the P, K, S, B, and Mo concentration of alfalfa using three different sampling protocols (whole plant samples, top 15 cm samples, or fractionated plant samples. Alfalfa was sampled at early bud, late bud, and 10% bloom for all three cuttings to determine the effect of plant maturity and time of year on nutrient concentration.

Nutrient concentration declined with advancing maturity for all sampling methods and nutrients. The concentrations of B and Mo decreased slightly with advancing maturity, but the degree of decline was not considered to be sufficient to warrant adjusting critical values. There appeared to be no advantage to sampling portions versus whole plants suggesting adaptation of the most practical method (whole plants) for sampling. Cored bale sampling (similar to whole tops) may be a recommended procedure due to ease of use and the ability to combine with normal sampling for forage quality analysis. *CA-26F*

Nitrous Oxide Emissions from the Application of Fertilizers: Source Partitioning

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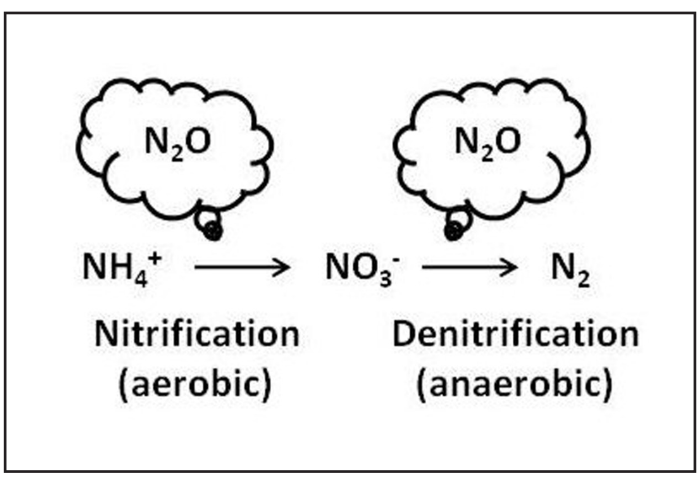
There is considerable interest to identify and implement agricultural practices that optimize nutrient management and reduce greenhouse gas emissions. Many California agricultural conditions are ideal for the production of food, but also nitrous oxide (N_2O) losses. Improving fertilizer use efficiency by better coordination of N availability and crop demand is beneficial. On-farm research was conducted in Yolo County to investigate the effect of management on annual N_2O fluxes and to determine the source of the observed N_2O fluxes.

In the first study, drip irrigation and fertigation were found to significantly reduce N_2O emissions compared with furrow irrigation. The reduced N_2O emissions are likely due to better synchrony between N availability and crop demand. Fertigation allows for more control over how much N is being added and there is less mineral N in the soil. Win-win examples like this need to be communicated as much as possible to ensure formulation of policies for climate change mitigation and adaptation that benefit everyone involved.

In a second study we also tested Natural Abundance (NA) ^{15}N techniques to source partition N_2O in a conventionally managed tomato cropping system. With this NA technique, lighter atoms react faster than heavier atoms, resulting in an isotopically enriched substrate and a depleted product. Enriched ^{15}N was also utilized in other treatments. Some key results included: 1) the calculation of the fraction of N_2O derived from denitrification, nitrification, or from other sources during our one-week experiment; 2) daily field measurements of ^{15}N in N_2O and mineral N allowed us to track the rapid changes in mineral N forms in the soil; 3) a better understanding of fractionation factors for nitrification and denitrification derived N_2O emissions and N_2O reduction to N_2 for the soil. *CA-29F*



Potassium Fixation and its Significance for Crop Production

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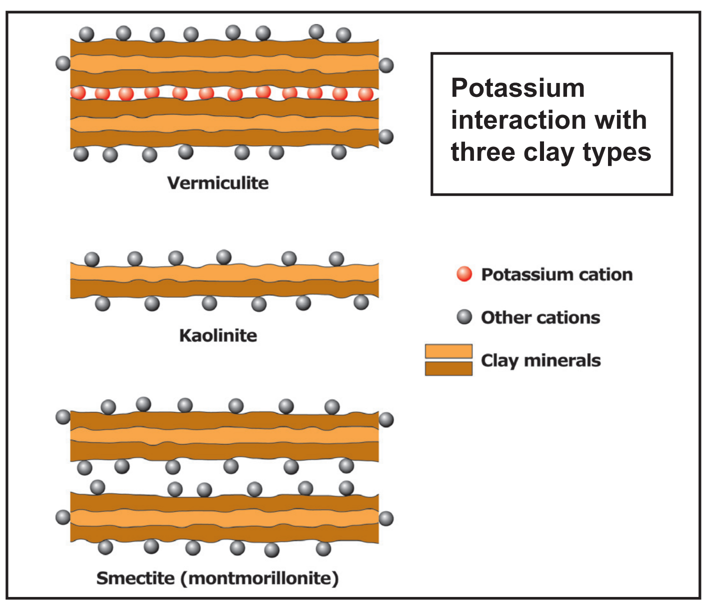
Project Cooperator: Randal Southard

Potassium is found in several fractions in soil, but only the soluble and exchangeable forms are important for immediate plant nutrition. Potassium that is fixed in montmorillonite clay readily diffuses back into soil solution and becomes available for plant uptake. However, vermiculite clay complexes K very strongly and it is only released very slowly back into solution. Although vermiculite is chemically a clay mineral (layer silicate), it can also occur in the silt and sand size fractions. Vermiculite is a weathering product of biotite mica minerals and is commonly found on the east side of the San Joaquin Valley in California. The extent and distribution of these K-fixing soils has been examined in previous IPNI-supported research. This current research is looking at how to manage fertilizer K to meet the needs of drip-irrigated wine grapes on these vermiculitic soils.

Winegrapes grown in this region often experience K deficiency, but excess K in juice and wine is also a problem. These vineyards are typically drip-irrigated, which restricts the volume of the rootzone. The high K demand under heavy fruit load and competing soil fixing reactions make nutrient management difficult. Field experiments are underway to look at appropriate K fertilizer strategies. Potassium-fixing soils may require thousands of pounds of potash per acre before a point is reached where only maintenance K applications are required. Fixed K is slowly available to plants, but is not well estimated by the usual soil test procedures such as with the ammonium acetate extract. Improvements of the current lab tests are being examined, including better interpretation of the analytical results. The study is also studying the impact of soil drying on K fixation and release. *CA-31F*



Utah

Utah-Specific Potassium and Phosphorus Nutrient Management for Tart Cherry Productivity and Quality

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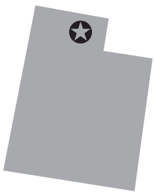
Project Cooperators: Brent Black and Earl Seeley



Tart cherries, also called sour or pie cherries, are best known as ingredients in desserts and beverages. Nearly all tart cherries are frozen, canned, or dried. Fertilizer recommendations for cherry production in Utah are very old or not in existence. Improved fertilizer management is known to increase fruit yields, improve cherry quality and color, improve the health benefits of the fruit, and enhance grower profitability. The first-year study established single-tree plots that received variable P and K application in a factorial design from multiple P and K fertilizer sources. Applications were made to all trees in May and again in June for some treatments. Leaf and fruit samples were collected during the growing season and analyzed for nutrients. Fruit yield and quality were monitored at harvest. The experiment is conducted on three sites: two commercial orchards and one research farm.

In the first full year after establishment of treatments, the trees had very high cherry yield due to their alternate bearing pattern. Yields were generally greatest when a 1:1:1 ratio of N:P:K was applied in May and again in June. The chemical analysis of tissue samples is still underway. With most tree experiments, it is important to repeat the measurements for multiple years. This helps to account for weather variables, alternate bearing patterns, and the nutrient reserve stored within the tree that can mask short-term nutritional changes. The continuation of this study will lead to improved production levels and better leaf diagnostic tools. *UT-07F*

Washington

Root Responses to Fertilizer Placement and Source

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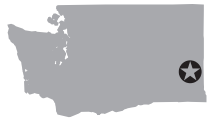

Previous methods to monitor root development and their response to fertilizer have suffered from major limitations. Recent advances in digital scanners now enable the capture of high resolution root images at low cost and provide real-time monitoring of plant development.

An imaging method was developed to evaluate crop species differences in root and root hair morphology using high resolution scanners and to determine if the method could detect root responses to nutrient source and placement. High resolution desktop scanners (1890 pixels/cm) were buried in containers filled with soil to monitor root development. This new technique can successfully track a single root or root hair over short time intervals (~10 min), which is useful in determining temporal and spatial patterns of root hair growth and development in the soil environment. A major advantage of this method is its provision of large, high resolution images of root systems growing through soils, allowing for the characterization of root hair development in space and time without disturbance.

Preliminary scans have examined the effect of fertilizer source and placement on root growth and proliferation. Images will be posted on the IPNI website as they become available *WA-14F* ■

Nutrient Source Specifics

is a series of brief, condensed, one-page fact sheets highlighting common commercial fertilizers and nutrient sources in modern agriculture. These topics are written by scientific staff of the International Plant Nutrition Institute (IPNI) for educational use. Mention of a fertilizer source or product name does not imply endorsement or recommendation. This series is available as PDF files at this URL:
>www.ipni.net/specifics<

1. Urea
2. Polyphosphate
3. Potassium Chloride
4. Compound Fertilizer
5. Potassium Sulfate
6. Potassium Magnesium Sulfate: Langbeinite
7. Urea-Ammonium Nitrate
8. Thiosulfate
9. Monoammonium Phosphate (MAP)
10. Ammonia
11. Potassium Nitrate
12. Ammonium Sulfate
13. Sulfur
14. Triple Superphosphate
15. Nitrophosphate
16. Gypsum
17. Diammonium Phosphate
18, Calcium Carbonate (Limestone)
19. Phosphate Rock
20. Coated Fertilizer
21. Single Superphosphate
22. Ammonium Nitrate