NEWS & VIEWS

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Dr. A.E. (Al) Ludwick, Western Director

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Searching for Answers in 2001 and Beyond

EACH year the Potash & Phosphate Institute (PPI) and the Foundation for Agronomic Research (FAR) help support research projects across North America. These projects involve crop production in the field… research to develop efficient, high yielding systems. They are designed to answer current production questions and related environmental concerns.

In 2001, PPI is assisting with seven FAR-supported research projects in the western U.S. Three projects that were completed at the end of 2000 are also included. Following is a brief summary of each project. Please understand that for projects still in progress the release of detailed results is strictly up to the researcher. If any project is of special interest, you might want to contact the researcher to get a first-hand update.

More information is also available via the Internet at these websites: www.ppi-ppic.org or www.ppi-far.org.

Arizona

Effects of Fluid Phosphorus Fertigation on Growth and Yield of Microsprinkler-Irrigated Citrus in the Desert Southwest

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Project Cooperator: Mr. James Truman.

The objectives of this project were to evaluate phosphorus (P) fertigation through microsprinklers for yield and quality of grapefruit and to update P tissue test guidelines for use in desert climates such as central Arizona. This three-year project was initiated in the spring of 1998 and terminated at the end of 2000.

The experiment, conducted at the University of Arizona Citrus Agricultural Center, consisted of phosphoric acid (0, 41, 82, 124 lb P_2O_5/A) injections split monthly into the microsprinkler irrigation system. There were no significant effects of P fertilization on fruit yield or quality in the first or third years, although available soil P (Olsen bicarbonate) levels increased 30 to 60 percent after the first year. However, in the second year, yields were very high, reflecting the alternate-bearing tendency sometimes exhibited by citrus, and significant responses to applied P were observed. Responses included increased yield, lower peel thickness, and higher solid/acids ratio (sweeter fruit) compared to control (no P) trees. Tissue test P values did not appear to be useful in predicting tree P response.

It was concluded that in years of high yield potential, P applications will likely result in higher fruit yield and quality. Therefore, it is recommended that growers regularly incorporate modest annual or bi-annual P applications (0.5 to 1.0 lb P_2O_5/tree).

Evaluation of Balanced Cotton Nutrition Management

Project Leader: Dr. Jeffrey C. Silvertooth, Dept. of Plant Sciences and Dept. of Soil and Water Sciences, University of Arizona, Tucson, AZ 85721. Phone (520) 621-7616, fax: (520) 621-7186, e-mail: silver@ag.arizona.edu

The purpose of this project is to evaluate various commercial cotton fertilization regimes involving nitrogen (N), P, potassium (K), and micronutrients in relation to the University of Arizona fertilizer guidelines. It was initiated in 1999 with support from PPI, although it actually began in 1998. It was concluded at the end of 2000.

Phosphorus nutrition was evaluated in 1999 and both P and K in 2000. Individual plots, replicated three or four times, extended the length of the irrigation run and were large enough to be harvested into separate modules. A summary of over 20 site-years for upland and Pima cotton

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involving banded P studies, including the 1999 sites, suggest that the current University of Arizona guidelines are appropriate. The guidelines suggest there is a high probability of response to P if the soil test (Olsen bicarbonate) is less than 5 parts per million (ppm), medium probability between 5 and 10 ppm, and low probability above 10 ppm. Field sites tested high in available soil K in 2000, and no yield responses to applied K were observed.

Response of 'Lisbon' Lemons to Potassium Fertilizer on a Sandy Soil

Project Leader: Dr. Charles A. Sanchez, Department of Soil, Water and Environmental Sciences, Yuma Agricultural Research Center, University of Arizona, Yuma, AZ 85364. Phone: (502) 782-3836, fax: (520) 782-1940), e-mail: sanchez@ag.arizona.edu

Project Cooperators: Drs. Abraham Galadima and Glen C. Wright.

This project evaluates the effectiveness of different rates and sources of K fertilizer [potassium chloride (KCl) and potassium sulfate (K_2SO_4)] applied directly to the soil (Superstition sand), to the foliage, or in combination for lemons grown in western Arizona. It was initiated in 1999.

The trees at the beginning of the project were 1.5 years old and were not yet producing. All trees increased in size the first two years of the experiment and did not display any visual nutritional disorders. There were no significant differences in trunk diameter due to treatments in 1999. However, in 2000, trunk diameters were less for those trees receiving K applications.

This is a major citrus growing area in Arizona, and there is little research information supporting present fertilizer practices. Previous observations indicate that Superstition sand commonly used for citrus production is potentially K deficient.

California

Reassessment of Potassium Critical Values and the Predictive Value of Early Leaf Potassium in Almonds

Project Leaders: Dr. Patrick Brown, Department of Pomology, University of California, Davis, CA 95616. Phone: (530) 752-0929, fax: (530) 752-8502, e-mail: phbrown@ucdavis.edu; and Steven Weinbaum.

Project Cooperators: Roger Duncan and Edwin Reidel.

Almond yields have increased substantially since the University of California (UC) guidelines for leaf K were first published in the early 1960s. Increasing numbers of growers and analytical laboratories are concerned that current UC guidelines for leaf K are inadequate. This project was conducted from 1998 through 2000 to evaluate and update these guidelines and to measure yield and quality responses to K fertilization.

A vigorous almond orchard with low leaf K levels was chosen as the study site. Baseline yields for individual trees were determined in the initial year, and K_2SO_4 was applied annually at 0, 120, 240, and 360 lb K_2O/A to establish a broad range of tree K nutrition. Survival of fruiting spurs from 1999 into 2000 was 23 percent greater, and spring flowering of the surviving spurs was 20 percent greater under high K availability compared to low K availability. Nut yield was increased by 400 meat lb/A. It was concluded that July leaf samples are generally predictive of next season's productivity, but not the current season. Leaf K concentration of 1.4 percent is adequate for maximum yield.

Note: an article about this project appears in *Better Crops with Plant Food* magazine, Vol. 85, 2001, No. 3, pages 21-23. Check the website at www.ppi-ppic.org.

Predicting Potassium Availability in Rice Fields under Alternative Rice Straw Management Practices

Project Leader: Dr. Chris van Kessel, Department of Agronomy and Range Science, University of California, Davis, CA 95616. Phone: (530) 752-4377, fax: (530) 752-4361), e-mail: cvankessel@ucdavis.edu; John F. Williams, County Director and Farm Advisor, Sutter and Yuba Counties; and Dr. William R. Horwath, Department of Land, Air, and Water Resources, University of California, Davis.

Project Cooperators: Eric Byous and Dr. Randall Mutters.

The purpose of this project is to re-evaluate the accuracy of soil K tests for predicting K fertilizer needs for rice production. The K supplying power of flooded rice soils will also be studied as affected by alternative (to burning) rice straw management practices. The project was initiated in 1999.

The results indicate that ammonium acetate (NH_4OAc; 1.0, 0.75, or 0.50 M) and 1.0 M nitric acid (HNO_3) soil extraction methods are accurate for detecting K deficiencies and determining K fertilization requirements in flooded rice soils. Over two growing seasons, straw incorporated treatments showed a 150 percent higher available soil K concentration than straw removed treatments. Potassium fertilization ranging up to 134 lb K_2O/A significantly increased yields in 2000 when straw was removed, but not when it was incorporated (across all N rates: 5,790 lb/A versus 6,520 lb/A).

Potassium deficiency is being observed in some rice fields in the Sacramento Valley. Such deficiencies are expected to rapidly increase if rice straw removal from fields becomes a common practice, rather than burning or incorporating. A reliable K soil test will support increased fertilizer K use on potentially deficient fields.

Potassium Foliar Application to Increase Nut Yield and Quality in Pistachio

Project Leader: Dr. Patrick Brown, Department of Pomology, University of California, Davis, CA 95616. Phone: (530) 752-0929, fax: (530) 752-8502, e-mail: phbrown@ucdavis.edu

The objectives of this project are to determine if foliar K application or K fertigation during nut fill can satisfy the pistachio K requirement and effect more efficient fertilizer use than conventional soil application. This project was started in the spring of 2001, and data are not yet available.

Idaho

Chloride's Role in Maximizing Wheat Performance (Multi-Regional Project)

Project Leader: Dr. Brad Brown, University of Idaho, SW Idaho Research & Extension Center, 29603 U of I Lane, Parma, ID 83660. Phone: (208) 722-6701, fax: (208) 722-6708), e-mail: bradb@uidaho.edu

This project was initiated in the fall of 1997 as part of a multi-regional project begun several years earlier. It was terminated in 2000 after three seasons.

An irrigated winter wheat trial involving 16 varieties (mostly soft white, some hard red) was planted in the fall of 1997, and 10 varieties were planted in the fall of 1998. There was only minor physiologic leaf spotting among the varieties studied despite low soil and plant chloride (Cl) levels. Chloride fertilization did not increase yields that averaged 96 bu/A in 1998 and 97 bu/A in 1999. It was observed that yields may have been limited both years by moisture stress during stem extension. Kernel weights of 200 seeds and test weights were increased both years with Cl when averaged across varieties. The experiment was moved to a field testing low in Cl on the Parma Research and Extension Center for the 1999/2000 season. Four of 15 varieties studied (WPB-470, Rod, Hawk, and Promontory) responded positively to 40 lb Cl/A at 10 percent probability level, and one (Hiller) responded negatively. Yields were substantially higher than previous years, ranging from 120 to 165 bu/A. In a separate Cl rate trial, Stephens wheat significantly responded to Cl fertilization, producing a maximum yield of 164 bu/A with 80 lb/A of Cl.

Precision Fertilization of Irrigated Potatoes in Southern Idaho

Project Leader: Dr. Jeff Stark, University of Idaho, Research and Extension Center, P.O. Box 870, Aberdeen, ID 83210. Phone: (208) 397-4181, fax: (208) 397-4311, e-mail: jstark@uidaho.edu

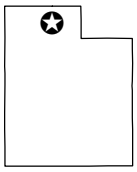
Project Cooperators: Ralph Oborn, Curt Pengelly, and Greg McCoy.

The purpose of this project is to evaluate P and K management in precision fertilization systems for potatoes. The project was initiated in 1998, although PPI began support in 1999.

The study was continued during the 2000 growing season on a 379-acre potato field irrigated with a center pivot system. Three sets of three 70 ft.-wide fertilizer treatment strips which extended across the entire field were established prior to planting. In each of the three sets, 1) conventional, uniform fertilization was compared with 2) site-specific fertilization based on a 2-acre grid nutrient map, and 3) zone fertilization in which management zones were delineated using a bare soil aerial image. Zone and site-specific fertilization increased marketable yields by 6 and 10 percent, respectively, compared to conventional fertilization. Impact on quality was much greater, with large No. 1 tubers increasing by 75 and 80 percent. Crop values for the zone and site-specific treatments were $52 and $175/A higher, respectively, than the conventional treatment, but net returns were only $7 and $134/A higher due to higher sampling and application costs.

Potatoes require a very high level of balanced nutrition for optimum yield and quality. This project will help define the best approach to fertilizer management in southern Idaho for this important crop.

Utah



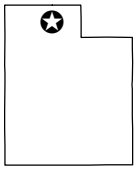
Phosphorus and Potassium Soil Test Relationships and Nutrition for Irrigated Alfalfa Production in Utah

Project Leader: Dr. Richard T. Koenig, Department of Plants, Soils and Biometeorology, Utah State University, Logan, UT 84322-4822. Phone: (435) 797-2278, fax: (435) 797-3376, e-mail: richk@ext.usu.edu.

Project Cooperators: Dr. Jan Kotuby-Amacher, James Barnhill, and Jody Gale.

This project is a continuation of earlier P and K fertilizer research on irrigated alfalfa initiated in 1996. Results from the earlier study demonstrated a good response to P, but inconsistent yield responses to K fertilization, possibly due to the use of K rates that did not generate high enough soil test K levels.

Three sites with initial soil test K values ranging from 70 to 90 ppm were involved in the 2000 trial. Potassium fertilizer (KCl) was applied at rates of 0, 100, 200, 400, and 600 lb K_2O/A in spring and as a split application of 300 lb K_2O/A applied in spring and an additional 300 lb after the first cutting. Available soil K increased 1.0 ppm for each 5 lb K_2O/A applied at one site and each 12.5 lb K_2O/A applied at the remaining two sites. Alfalfa responded to K fertilization at all sites, with yield responses ranging from 1.0 to 1.4 tons/A. Yield was reduced with the 600 lb K_2O/A single application rate at one of the three sites, while split application of the 600 lb/A rate did not reduce yield. These results indicate that alfalfa may respond to high rates of K fertilizer on low K-testing soils and that relatively high rates of K are necessary to increase soil test K to adequate levels on low K-testing soils. Rates of KCl fertilizer exceeding 400 lb K_2O/A may need to be applied in split treatments to prevent yield reductions.



Fertilizer Requirements for Long-Term Sustainability of High Yielding Crops

Project Leaders: Dr. Richard T. Koenig, Department of Plants, Soils and Biometeorology, Utah State University, Logan, UT 84322-4822. Phone: (435) 797-2278, fax: (435) 797-3376, e-mail: richk@ext.usu.edu; and Dr. Von D. Jolley, Department of Agronomy and Horticulture, Brigham Young University, Provo, UT.

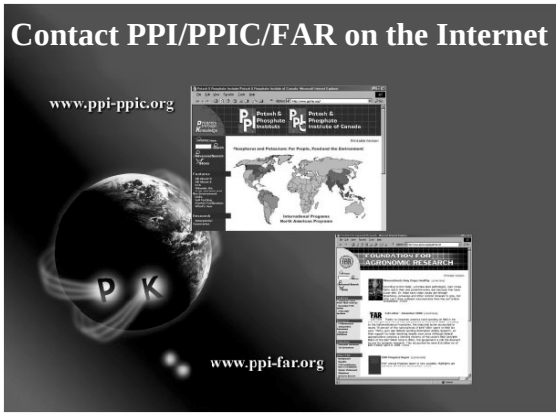
The purpose of the "Utah Centennial Plots" is to evaluate the long-term sustainability of yield and the effects on soil properties of organic (manure), inorganic (fertilizer), and combined organic and inorganic fertilizer programs on two crop rotations: alfalfa-wheat and alfalfa-corn-wheat. The study was initiated in 1996 with alfalfa and wheat as the first crops in the rotation and will continue indefinitely.

The 2000 wheat yields averaged 29 bu/A for the unfertilized control, 71 bu/A for the inorganic fertilizer, 65 bu/A for the organic (based on N requirement), and 80 bu/A for the combined organic (based on P requirement) and inorganic (supplemental N) treatments. Alfalfa yields averaged 7.4 tons/A for the unfertilized control, 8.3 tons/A for the inorganic fertilizer, 7.9 tons/A for the organic, and 7.9 tons/A for the combined organic (based on K requirement) and inorganic (supplemental P) treatments. Annual applications of dairy manure based on the N requirements of wheat (150 lb N/A; 0.30 manure N availability factor) have resulted in a linear increase in soil test P of 4 ppm per year. Annual applications of dairy manure based on soil test P recommendations and referenced P mineralization rate factors have failed to achieve soil test values equivalent to inorganic P fertilizer treatments.

This program will ultimately define high yield sustainability for these two rotations relative to inorganic vs. organic inputs and define best management practices (BMPs) for these materials used singly or in combination.

Summary

We at PPI/FAR are pleased to be part of research and education programs that advance the cause of efficient production agriculture. ■



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Each of the regions of North America and globally where the Institute has agronomic research and education programs now has an individualized website accessible from the central site.