

STATE REPORTS

Western Coordinating Committee 103 Annual Meeting
University Park Marriott Hotel, Salt Lake City
March 7, 2001

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ALASKA

Alaska Cooperative Extension Service (ACES) and the Agricultural and Forestry Experiment Station (AFES) have recently filled a horticulture position at the Palmer Research Center. ACES appointed two Land Resources agents, one at Palmer and one at Delta Junction, both filled at the B.S. level. AFES was unsuccessful in recruiting a forage Agronomist (second search) and the range management position has been offered to a candidate. The School of Agriculture and Land Resources Management (SALRM) has initiated the recruitment process for a Dean.

Work in Alaska continues to focus on forage S fertility, C cycling under arctic conditions, alternative crop production, N fixation of perennial legumes, dairy waste management, and no-till forage stand renovation (SARE grant).

The dairy waste research will conclude this summer with experiments on dairy manure source, application rates and timing on perennial grass hay stands and the residual effects of similar treatments on annual grass yield and nutrient uptake.

NUTRIENT MANAGEMENT IN ARIZONA

Report to WCC-103 7 March, 2001

Submitted by Thomas L. Thompson, Associate Professor, University of Arizona

A wide variety of crops are grown in Arizona, including cotton, alfalfa, and durum wheat, which occupy the largest acreages in the state. Other important crops include lettuce, broccoli, citrus, melons, and a variety of other crops. Research is currently addressing nutrient management needs for a number of these crops.

Cotton. Two field experiments were conducted in Arizona in 1999 at two locations (Maricopa and Marana). The Maricopa experiment has been conducted for nine consecutive seasons, the Marana site was initiated in 1994. The purposes of the experiments were to validate and refine nitrogen (N) fertilization recommendations for Upland cotton. An evaluation of a calcium (Ca²⁺)-based soil conditioner was conducted during the 1999 cotton season at two locations. Both studies involved the use of CN-9, a Ca – nitrate solution with 9% nitrogen and 11% Ca. Numerous field experiments were conducted during the 1997 through 1999 cotton

seasons involving macro and micronutrient fertilization. The purpose of these experiments was to evaluate University of Arizona fertility guidelines with respect to soil test results and to possibly fine-tune or better calibrate these guidelines for common Arizona soils and cotton growing regimes. A single field experiment was conducted in 1998 and 1999 to evaluate a scheduled (based upon stage of growth) versus a feedback approach (based upon growth parameters and crop conditions) to nitrogen (N) and mequiat chloride (Pix_{TM}) applications on Upland cotton. Two studies were conducted in 1996 and 1997 at the University of Arizona Maricopa Agricultural Center (MAC) to evaluate the added nitrogen interaction (ANI) or 'priming effect' on the determination of nitrogen recovery efficiencies (NRE). The method employed was to compare NRE's as calculated by two different methods; the difference technique and the isotopic technique.

Alfalfa. Alfalfa response to applications of two P fertilizers, 10-34-0, and 11-52-0 is currently being evaluated. Alfalfa yield summed over three years was similar for water-run 10-34-0 and broadcast 11-52-0. Whether 10-34-0 is sprayed on the surface of the soil or water-run did not affect yield except for the first cutting in 1999 where water-run gave a slightly higher yield. The results of this study suggest that water-run 10-34-0 does not result in higher yields than broadcast 11-52-0 at equivalent rates of P.

Small Grains. Experiments have been completed to 1) develop tissue test guidelines for late-season N applications to durum wheat, and 2) develop sap nitrate testing guidelines for durum wheat, barley, and malting barley. Stem NO₃, sap NO₃, and flag leaf and whole plant N show promise as predictors of the need for late-season N applications to boost grain protein in durum. For malting barley, the correlation coefficient between sap NO₃ and stem NO₃ was 0.74 across two varieties and two seasons. Therefore, measurements of sap NO₃ show promise for guiding late-season N applications for malting barley.

Citrus. Several studies are completed or in progress. Experiments at the University of Arizona Citrus Agricultural Center near Phoenix on microsprinkler-irrigated citrus suggest that recommended N rates can be significantly reduced for microsprinkler-irrigated citrus. We found no response to N by newly-planted navel oranges in their first two years of growth. Studies using ¹⁵N-labeled fertilizers showed that only 6% and 25% of the N applied were taken up by these trees in the first and second years after planting, respectively. Experiments on mature grapefruit have also shown that N rates for 5 to 9 year old grapefruit can be reduced to 0.3 to 0.7 lb N/tree/year, depending on age. We have also shown that the current critical tissue N concentration used for grapefruit (2.2%), is inappropriate for Arizona growing conditions. We have evaluated orange and grapefruit response to fertigation frequency in these studies. There was no yield response to more frequent fertigation, although leaf N concentrations were higher when trees were fertigated weekly or monthly compared to fertigation three times per year. The response of grapefruit to liquid P (0-52-0) applications is also being evaluated. During the first year, no yield or quality response to P was observed.

The effects of foliar lo-biuret urea and potassium phosphite on navel orange fruit yield and fruit size in a commercial production grove. Lo-biuret urea (28 lb N/a) and potassium phosphite (2 lb P/a) are being applied at various times during the year, alone and in combination, and compared to conventional grower practices.

Vegetables. The effect of fertigation frequency (daily, weekly, biweekly, monthly) on subsurface drip-irrigated broccoli yield, quality, and tissue NO₃ is being evaluated in a three-year study. We have found no significant effects of N fertigation frequency on a sandy loam soil in southern Arizona. Therefore, it appears that N fertigation frequency is not an important management variable for winter vegetable crops grown in medium-textured soils in Arizona.

Information provided by:

Mike Ottman, Charles Sanchez, Jeff Silvertooth, Tom Thompson, Jim Walworth, Glenn Wright

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WCC-103
NUTRIENT MANAGEMENT AND WATER QUALITY
COLORADO REPORT
March 7, 2001

Interdisciplinary precision agriculture research

The multi-disciplinary CSU/USDA-ARS research project is being conducted on center pivot irrigated corn in Colorado. Collection of baseline and research data have been an important aspect in analyzing the management strategies of the cooperating farmers. These farmers have demonstrated that their goal is to minimize risk by consistently applying sufficient fertilizers, pesticides, and irrigation water to make sure that none is limiting. However, these farmers have significantly reduced their irrigation and nitrogen inputs when shown the estimates of the over irrigation and documentation of over fertilization. We have found that sampling on a 250 ft x 250 ft grid is insufficient for adequately describing the variability of soil factors affecting nutrient, pesticide and water availability to a crop. Since the cost of the necessary number of samples is not economically feasible for most producers, alternative approaches are being explored. We received funding from the IFafa competitive grant program in 2000 for a three year study of different techniques to identify production level management zones. This research will include irrigation, weed, insect, disease, and fertilizer management as well as a major effort in remote sensing. Economic return to precision agriculture will also be evaluated. Results from this multi-disciplinary CSU/USDA-AR project we have been conducting for the last four years were the basis for our successful IFAFS grant competition. **Contact person:** dwayne.westfall@colostate.edu or heerman@wmu.colostate.edu

Management zones in precision agriculture

The cost/intensity of grid soil sampling necessary to identify the soil variability to develop accurate VRT fertilizer maps is prohibitive for implementation of precision agriculture in most agronomic crops. Therefore, we have conducted research for three years to determine if production level management zones based on soil color from an aerial photograph, topography and the framers' management experience is an effective alternative to grid sampling. We have found that zone sampling is effective in identifying suites of soils that have different production potential. Yield levels are also identified by this method. In cases where zones are not accurately identified, we have found that the inclusion of electrical conductance data collected with a Veris conductivity meter is effective in making finer zone distinctions and to separate inclusions of one zone in another that may not be identifiable using our former method. We will expand this research to include more sites, geographic regions and methods of zone identification as a result of our IFAFS funding. **Contact person:** dwayne.westfall@colostate.edu or fleming@wmu.colostate.edu

N credits from manure and irrigation water

Demonstration and study plots of irrigation water NO₃ and manure crediting are being conducted. The majority of this work is on irrigated corn for grain and silage. Irrigation is monitored over the cropping season on fields with varying rates of N fertilizer to determine crop utilization of NO₃ in the water. Groundwater sources in areas of the S. Platte basin routinely contain 15 to 40 ppm NO₃-N, a potentially significant source of N. Contact: tbaud@lamar.colostate.edu

Presidedress nitrate test (PSNT) on manured fields

Evaluation and demonstration of the PSNT on manured fields is being conducted. Fields receiving different manure treatments and N fertilizer rates are soil sampled at the 6 leaf stage to determine a soil NO₃-N level where no additional sidedress N is required. This method appears to be a good technique to guide farmers in making sidedress N applications with the ultimate goal of reducing leaching of nitrate into the ground water. The PSNT also shows promise for situations where manure needs to be applied based upon phosphorus need and supplemental nitrogen is needed. Contact: tbaud@lamar.colostate.edu

Biosolids studies

Our long-term bioavailability of Littleton/Englewood, CO biosolids continues at our two Bennett locations. In summer 1999, we established crop rotations consisting of wheat-fallow, wheat-corn-fallow, and wheat-wheat-corn-sunflowers-fallow on land owned by cities of Littleton and Englewood near Byers, CO. We will compare biosolids versus N fertilizer at "agronomic rates" within each rotation. Wheat, corn, and sunflower yields for 2000 were small since we established our plots in a field following a wheat crop lost to hail damage.

A large problem following wildfires is the rapid reestablishment of vegetative cover to reduce soil erosion. In 1997, we established a research site in the Buffalo-Creek wildfire burn area in Jefferson County, CO where we applied and incorporated Denver Metro composted biosolids at rates of 0, 5, 10, 20, 40, and 80 Mg ha⁻¹ followed by seeding with an US Forest Service approved mixture. We again found a significant linear effect of biosolids on

biomass production and plant canopy cover. Contact: K.A. Barbarick, J.A. Ippolito, and G.A. Peterson:
kbarbari@agsci.colostate.edu

Evaluation of the P Index as a predictor of phosphorus runoff from surface irrigated fields

Phosphorus runoff from furrow-irrigated fields in three different Colorado watersheds was evaluated from 1998 to 2000 in order to evaluate the use of the P Index for furrow-irrigated fields. Total P, bio-available P and ortho-P levels in irrigation runoff were generally low (total P averaged 0.40 mg/L) with only 3 of 39 sites containing total P levels in irrigation runoff greater than 1.0 mg/L. The National P Index ranked most fields (35 of 39) as having a high to very high P runoff risk. A modified P Index for Colorado has been developed for our conditions that more accurately reflects P runoff potential in Colorado. Contact: rwaskom@lamar.colostate.edu or jgdavis@lamar.colostate.edu

NH₃ loss during liquid swine effluent application

Evaluation of N availability after swine effluent application via center pivot was conducted 3 sites in Northeast Colorado over 2 years using a soil sampling approach. We found that 15-20% of the total NH₄-N applied was lost during sprinkler application and another 30-40% was lost from the soil surface over a 72 hour period. Increased wind speed and temperature increased volatilization losses. Nitrogen content of the lagoon did not significantly impact the percent of N lost over a 72 hour period.

Contact: rwaskom@lamar.colostate.edu

Analysis of Colorado aquifer sensitivity/vulnerability to nitrate contamination

GIS data layers are being assembled for Colorado soils, irrigation, and ground water properties to develop a series of maps that identify the relatively sensitive and non-sensitive aquifers in the state to contamination from agricultural practices. A vulnerability matrix is being developed in conjunction with the maps to allow site specific determination of the probability of contamination with a given chemical or management scenario. Contact:

rwaskom@lamar.colostate.edu

Evaluation of mountain meadow fertility management on stream water quality

A study was initiated in 2000 in the Gunnison River basin to evaluate nutrient, microbial, and sediment losses from 2 typical grazing management systems. Data will be compared to stream quality data collected in 1979 and 1980 at the same site. We found a flush of N and P in the runoff during the first irrigation following spring fertilizer application. Fecal bacteria levels were also high during early irrigations but decrease as the season progressed and manure aged. Small plot studies will be used during 2001 to evaluate runoff levels from a series of fertilizer rates applied to meadow grass. Contact: rwaskom@lamar.colostate.edu or jbrummer@lamar.colostate.edu

Interaction of root characteristics and N requirements

Our hypothesis is that potato varieties with large root systems require less N input. We used two varieties: Russet Nugget and Russet Norkota to test our hypothesis. R. Nugget total root length and mass were about twice as large as those of R. Norkota. The N uptake rate per unit root mass was the same. The N requirement of R. Nugget is at least 60 kg/ha lower for identical yields. We recommend that i) larger-rooted varieties be used, if economical and ii) breeders and genetic engineers improve the N uptake efficiency by root system manipulation to reduce nitrate leaching and nitrous oxide emission. Contact: Parviz Soltanpour psoltanp@agsci.colostate.edu, or Gant Cardon gcardon@holly.colostate.edu

Mobility of trace metals in biosolids amended soils

Column experiments were completed to determine the effects of amendment with biosolids on the solubility of Cu, Zn, and Pb in soil pore water 10 cm below the zone of biosolids incorporation. Elevated concentrations of all three metals were observed in leachates in both dryland and irrigated soils. Metal mobility is the greatest immediately after biosolids addition, and then decreases to near levels observed for unamended soils within one year following application. At the current rate of metal export from the surface layers, many years of applications would be required before significant increases in total metal concentrations are detectable in the subsoil. Contact:

dheil@lamar.colostate.edu

Impacts of Irrigation and Fertilization of Mountain Meadows on Water Quality

Water quality parameters are being monitored at points of diversion, at several intermediate points, and at points where tailwater exits from two irrigated meadows near Gunnison, Colorado. Results from the 2000 season indicated spikes in nitrate, ammonia, orthophosphate, and fecal coliform levels. These high levels occurred shortly after commencement of irrigation in the spring, but quickly fell to levels that did not exceed water quality standards. Early spring fertilization and grazing contributed to the observed spikes. The effects of timing of phosphorus fertilizer application on water quality will be determined during the spring of 2001 as well as continued monitoring of the two meadows. Contact: jbrummer@lamar.colostate.edu

Evaluating Nitrogen Management Techniques on Production Level Management Zone

Recent advances in precision agriculture have developed techniques of dividing farm fields into sub-regions (i.e. Management Zones, MZ) based on the productivity potential of the sub-region. Growers believe in such MZ, but prefer to apply higher rates of N on low productive MZ and vice-versa. Research evaluating various techniques of N management was conducted on two different sites in Weld Co, Colorado. First year results indicate that high levels of N-use-efficiency are attained when N is applied to match the productivity potential of each MZ. Contact Raj Khosla at email rkhosla@colostate.edu.

Spatial N Removal from Management Zones (MZ)

Spatial N removal from MZ that received variable rates of N was conducted on 3 corn fields in NE Colorado to examine: (1) If differential rates of N are being removed from MZ; (2) If crop N stress can be sensed remotely via satellite; and (3) If N stress can be spatially quantified using SPAD chlorophyll meter. Spatial aboveground biomass samples were taken at corn growth stages V6, VT, and R6. Satellite imagery and geo-referenced spatial SPAD meter readings were also taken at the same time. Contact Raj Khosla at email rkhosla@colostate.edu.

Dryland cropping systems

The Dryland Agroecosystem project was initiated in fall 1985 and the working hypothesis is that no-till and minimum till practices will allow cropping system intensification beyond the long-term standard system of wheat-fallow because no-till improves capture and retention of the incident precipitation. After 12 years of research, we concluded that cropping systems with 3- and 4-year rotations were superior to 2-year wheat-fallow systems; they increased annualized grain production by 70% and economic return by 25-40% compared to wheat-fallow. In 1998 wheat-fallow was eliminated from the experiment and wheat-corn or sorghum-fallow became the standard of comparison. A 3-year continuous wheat-corn-soybean and a 4-year continuous wheat-wheat-corn-soybean system were added to the experiment. Roundup Ready soybean provides excellent control of grassy weeds like sandbur and soybean is harvested early enough to permit planting of winter wheat the same fall. Farmer applications of our research has increased as evidenced by an increase in dryland corn acreage from 23,700 in 1975-86 to 100,000 in 1995, 110,000 in 1996, 150,000 in 1997, 240,000 in 1998, and to 290,000 in 1999. Sunflower acreage also increased from 63,000 in 1991 to 270,000 in 1999. In total summer crop acreage has increased by 473,000 in Colorado since 1986. Assuming that the summer crops are grown in a 3-year rotation (wheat-summer crop-fallow), it means that there has been a conversion of 1,419,900 acres in CO from wheat-fallow to wheat-summer crop-fallow. This has resulted in an increase in net return of \$17,748,750 per year, based on an increased return of \$12.50/acre as indicated by previous economic analysis. The net effect on the environment is positive because our new systems provide high amounts of year around cover that reduce soil erosion by 80 to 99%, which in turn improves both air and surface water quality. Contact person(s): gary.peterson@colostate.edu or dwestfal@agsci.colostate.edu

High-value uses for manure

Using manure for high-value uses such as soil remediation and organic farming increases the affordable transportation distances and, therefore, solves both soil quality and water quality challenges simultaneously. Our studies are evaluating the use of manure for remediation of eroded soils and the impact of manure on soil fertility on organic fruit and vegetable farms. Contact: jgdavis@lamar.colostate.edu

Manure management BMPs

We are evaluating the impact of manure management practices such as manure application and incorporation timing and N vs. P-based manure application rates on runoff water quality and crop production. In addition, we are

beginning a project evaluating filter strips for filtering feedlot runoff and working with Animal Science on feeding practices which reduce N and P excretion by cattle. Contact: jgdavis@lamar.colostate.edu

Phosphorus runoff

Colorado State University is a part of the national benchmark P runoff project. We are quantifying the relationship between runoff P concentration and soil test P levels on three calcareous soils in CO, NE, and KS. Contact: jgdavis@lamar.colostate.edu or rwaskom@lamar.colostate.edu

Soil salinity

We are focusing on decisions that farmers can make to alleviate salinity problems on their farms. In particular, with a focus on onions in the Arkansas Valley, we are looking at varietal tolerance of excess salinity, slow release fertilizer to reduce soil salinity during the seedling stage, and the impact of drip and furrow irrigation on salt distribution in the beds. Contact: jgdavis@lamar.colostate.edu

Idaho Report

University of Idaho

Brown-irrigated western Idaho

Phosphorus placement for fall bedded and fumigated onions.

Metam sodium (Vapam) fall fumigated onion beds reduce P availability in the spring planted crop, especially in low organic matter soils with lime. Banded and broadcast P is employed by growers. Banded P has potential for reducing P in surface runoff as well as increasing P utilization by onions. But this three year study show no advantages to banding P between double planted onion rows. Wheat following these onions showed residual fumigation effects on available P over a year later.

Protein response to late season N as affected by planting date and variety.

Late season applied N is commonly used to increase hard wheat protein, but the protein response to late season N under wide ranging planting dates has not been evaluated for this area. A field study has been initiated to evaluate the protein response to late season N in three hard spring varieties planted from late fall to late spring. Planting dates and varieties have differed in protein but the protein response to late season N has not been affected by these in the first two years of testing. In contrast to many studies relating yield to protein, our results show the highest protein to be associated with the most productive planting dates.

Chloride soil test calibration for irrigated wheat.

Physiological leaf spot (nonpathogenic) is common in western Idaho but is seldom severe. We don't know if the incidence in susceptible varieties is influenced by Cl. Studies continue in western Idaho to measure the response to both soil test and plant Cl and applied Cl in winter and spring wheat. Wheat varieties were shown to have different potential for Cl uptake.

Winter and spring wheat response to P

Winter and spring wheat varieties as well as spring barley varieties are being evaluated for their relative response to P. Documenting these differences will facilitate future soil test calibration. The wheat flour quality (starch viscosity) response to P is also being examined in collaboration with cereal chemists in Moscow. Final starch viscosity is reduced and soft wheat starch quality improved with adequate P. Wheat varieties were shown to differ in their yield response to previous fumigation and available P.

Bean market class response to P

The response of three bean market classes (blacks, pintos, and great northern) to P rates in a high lime soil were evaluated. Beans over two years were unresponsive to P in this high lime soil even though soil test P was marginal. Beans appear to be less responsive to low P than other southern Idaho crops.

Onion response to fall applied slow release N sources

Effective fall applied slow release N sources could eliminate the need for multiple side dressings in the spring. Whereas polymer coated urea was more effective than other fall applied conventional N sources, it was not more effective than multiple sidedressings in the first year of study.

Alfalfa seed response to mobile (B) and nonmobile (Zn, Mn, Cu, and Fe) micronutrient placement

Micronutrients were evaluated using deep knifed, broadcast, and foliar applications. Yields in the second year were increased with micronutrients regardless of placement. Tissue samples at late bud were ineffective indicators of micronutrient availability. Seed concentrations of micronutrients were generally highest with foliar applications.

Removal of P with a double crop forage system

An annual double crop forage system consisting of fall planted small grains taken as forage at the late boot stage in spring and followed by a normal season silage corn crop has potential for increasing the rate of P removal and soil P drawdown in sites enriched excessively with animal wastes. Annual P removal has approached 60 lb/A.

Stark - southern Idaho

Cooperative Fertilizer Evaluation Program

The Cooperative Fertilizer Evaluation Program (CFEP) continues with his oversight with fewer sites than previously, the information to be used for evaluating large scale response to UI fertility recommendations. The focus in this program is turning from potatoes and sugarbeets to other crops such as small grains, alfalfa, and beans.

Precision Ag

Precision Ag Potato study comparing Zone and Grid sampling with conventional soil testing for P. Three years of results indicate \$50/A greater returns over conventional sampling with no differences in amount of P applied. Differences in dollar returns due primarily to increased size of tubers.

HRS N and Water Management

Evaluation of both N and water management for spring hard red and white market classes for their effects on protein quality in conjunction with the spring wheat breeding program at Aberdeen.

Robertson-eastern Idaho

Winter and Spring Small Grain Variety and Market Class Response to Fertilizer N

Small grain variety release does not always include nutrient response data for optimizing variety performance. New variety releases for different market classes are screened for their response to N timing and rates and other cultural practices.

Spring wheat response to P in soils with variable lime

A P rate study in dryland spring wheat was imposed over a site with variable lime to gain information on the adjustment in the P recommendation required for variable lime soils.

Fallahi-western Idaho

Fuji apple N requirements

Fuji apples are a relatively new apple for the Pacific Northwest. The N requirements of Fuji apples are being examined in order to optimize yield, storability, and fruit quality.

Guy-rainfed northern Idaho

N Fertilization of Yellow Mustard

Yellow mustard varieties are evaluated for their response to N in efforts to develop fertilization practices for a new condiment mustard crop in the Pacific Northwest. The N response of both spring wheat and yellow mustard are also evaluated after other brassica, cereal, and legume previous crops.

Personnel

Daniel Strawn. Environmental Soil Chemist, filled the position previously held by Scott Fendorf.

Jody Johnson-Maynard, Soil and Water Management Chemist, filled the Denny Naylor position

Jason Ellsworth, Extension Soil Specialist for Twin Falls, to arrive sometime in April to finally fill all the faculty positions in the soils division.

Bob Mahler has assumed primarily a teaching load in soil fertility and environmental sciences and extension programming water quality.

Nutrient Management Legislation

Idaho Dept. of Ag has proposed legislation to amend the Fertilizer Law and has proposed a separate Soil and Plant Amendment Law which will include composts. Although the Fertilizer Law was revised last year from the previous 1967 statute, it was amended again this year to include an auditing authority. Insuring equal payment of the fertilizer tax by all fertilizer dealers, using the auditing authority, may facilitate consideration of a fertilizer tonnage tax increase of \$.05/T to support nutrient management research.

The July 1, 2001 deadline for submittal of Nutrient Management Plans for all Idaho dairies is looming. Roughly 3/4 of the dairies have yet to complete their plans. NRCS has trained about 300 nutrient management planners but only about 20 have been certified and are writing plans.

Idaho Nutrient Management Coordinating Team

We have initiated a coordinating team to better facilitate nutrient management programming in Idaho extension and research programs. Still in its infancy, we hope to hold a bi-annual conference, support a website, offer nutrient management training, and evaluate nutrient management needs of practitioners.

Oregon State University Report WRCC-103 Nutrient Management and Water Quality March 7, 2001

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Extension projects

Phosphorus Index for Oregon and Washington. Oregon and Washington Universities worked cooperatively with NRCS in the two states in adapting the generic national P Index for use in the Northwest. Separate Indexes were developed for west and east of the Cascades. The west of the Cascades Index focuses on reducing the risk of P transport via winter runoff and erosion events. The east of the Cascades Index focuses more heavily on P transport associated with irrigation. OSU representatives on the P Index working group were Dan Sullivan and John Hart.

Pacific Northwest Collaborative Nutrient Management Education Program. This Western SARE Professional Development project, involving Oregon State University (Dan Sullivan, John Hart, and Don Horneck), Washington State University (Bob Stevens) and University of Idaho (Brad Brown) and collaborators from agencies and private industry is beginning this year.

The goal of the project is to increase the ability of professionals within NRCS, Cooperative Extension, Soil and Water Conservation Districts (SWCD), and private agronomists to support landowners in management decisions that minimize negative impact of nutrients on the environment while sustaining high productivity. The following educational efforts will be conducted during 2001-2002.

Workshops: A total of six two-day workshops are planned in Oregon, Washington and Idaho. Technical aspects such as nutrient transport processes, and sustainable nutrient source and transport management will be covered during the first day of the workshop. During the second day, we will cover comprehensive planning and give agricultural professionals and regulators an opportunity to collaboratively explore short- and long-term consequences of alternative management strategies.

Resource notebook and extension publications: Workshop participants will receive a resource notebook containing training materials such as lists of resource people, printouts of presentations, worksheets, and extension publications on soil nutrients, soil sampling, crop nutrient uptake and removal, and field practices that reduce off-site nutrient transport. Three new extension publications will be created and existing publications will be updated.

Website and newsletter: The website will provide up-to-date information on nutrient management, research, and policy. Newsletters will be published regularly during the funding period in print and electronic PDF format.

Research projects

Sweet Corn (Hart). The Pre-sidedress Soil Nitrate Test (PSNT) is successfully used for silage and grain corn production in western Oregon. Sweet corn acreage exceeds acreage of silage or grain corn in western Oregon. We desired to know if the PSNT could be used for predicting processing sweet corn sidedress N need. During 1996, 1997, and 1998, test sites were established in 31 grower fields. Plots with individual treatments of at least one acre in size were used to facilitate use of grower equipment. When the PSNT is greater than 25 mg/kg, grain or silage corn does not require sidedress N to produce 95% relative yield. Sweet corn data was not separated into responsive and non-responsive sites using this value. A Cate-Nelson plot of the data showed that when the PSNT from the surface foot of soil plus sidedress N was 200 kg/ha or more, no economic advantage was found for additional N. When the PSNT and sidedress N was less than 150 kg/ha, additional N always increased grower return. If the PSNT plus sidedress N was between 150 and 200 kg/ha, half the sites produced a return from additional N and half did not. In addition to the traditional use of the PSNT, which is to separate responsive from non-responsive sites, we were able to calibrate sidedress N for processing sweet corn.

Carrots for seed (Hart and Marvin Butler). Carrot-for-seed fields in central Oregon will be sampled throughout the growing season for biomass accumulation and nutrient uptake.

Green Beans (Hart). We will begin evaluation of the Pre-sidress Soil Nitrate Test (PSNT) in green bean production in cooperation with a grower in Willamette Valley.

Rhubarb (Hart and Bob McReynolds). Field plots will be initiated in the Willamette Valley to investigate N rate and/or timing for rhubarb production

Blueberries (Hart and Bernadine Strik). We will attempt to confirm iron chlorosis in blueberries from concentrated applications of urea. Plots will be at the North Willamette Research and Extension Center.

Christmas Trees (Hart and Jim Boyle, Brad Withorw-Robinson, Mike Bondi, Chal Landgren, Rick Fletcher and Steve Webster). We plan to measure soil pH, carbon, aggregate stability, resistance with a penetrometer, bulk density, and possibly mycorrhizal colonization in several plantations of varying age in western Oregon and Washington. We are attempting to assess the reason for a decline in growth after the first planting.

Cranberries (Hart, Tim Righetti, and Art Poole). The Mineral Nutrition working group from the North American Cranberry and Blueberry Research and Extension Workers will initiate a project to measure soil pH fluctuation in producing cranberry beds. Oregon will have a field site

PUBLICATIONS ISSUED DURING 2000-01

Abstracts (AB)

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Utah Report WCC-103 Nutrient Management and Water Quality March 7, 2001

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Nutrient Management and Water Quality projects and efforts

Amacher

·A chapter on methods of mine waste characterization has been published and reprints are now available.

·Two USGS open-file reports from the USGS Western U.S. Phosphate Project are now ready for release. One report summarizes selenium and other trace element concentrations in waste rock dump soils and undisturbed soils developed over phosphatic shale deposits (pre-mining baseline data), presents a model for Se mobilization from phosphatic shale, and proposes remediation strategies to minimize leaching and bioaccumulation of Se from waste rock dumps. The other report summarizes Se uptake by native and non-native plant species growing on a waste rock dump, a wetland below the dump, a reference wetland, and on native soils developed over phosphatic shale in a lease area.

·The Forestry Sciences Lab in Logan, UT will be the Forest Inventory & Analysis – Forest Health Monitoring soil quality monitoring lab for the western U.S. The soil characterization lab at the University of Missouri, Columbia, MO will be the lab for the southern U.S. and the Forestry Sciences Lab in Grand Rapids, MN will be the lab for the northeastern and north central U.S. All the labs will participate in NAFT.

Drost (returned from sabbatical leave in 2000)

·Onion nitrogen management with a controlled release fertilizer. Studies were conducted in 1998 and 1999 to evaluate a slow release N fertilizer (Polyon) relative to urea alone and in different combinations and rates on onions. Yield increased linearly as the percentage of Polyon increased in the mix at an application rate of 200 lb N/acre. The yield increase resulted from an increase in jumbo (3 to 4 inch) size onions as the total number of bulbs/acre was not affected. Cross-sectional soil sampling of onion beds at, and one month before, harvest indicated a significant difference in the spatial variability of residual nitrate-N as a result of N source. Generally, more N was concentrated beneath the onion bed with the Polyon treatments than with urea. A manuscript was recently submitted to Hort Science on this work. Grant proposals were submitted to three agencies/organizations to continue this work.

·Asparagus phosphorus management - new project beginning in 2001.

·Other vegetable fertility work continuing (N on pumpkins, melons, etc.).

Grossl

·Fate of iodine in soils. Perhaps, the most urgent reason to study the fate of iodine in soils is that several iodine containing compounds have been proposed as alternatives to CH₃-Br. Methyl bromide is a highly effective soil fumigant used to control soil borne pests for the production of numerous high value cash crops. However, it contributes significantly to the destruction of earth's stratospheric ozone layer and therefore, EPA has set the date for complete phase-out of CH₃-Br production and consumption beginning January 1, 2005. Thus, alternative fumigants that can readily substitute for CH₃-Br in terms of its

efficacy, low cost, and ease of use, are urgently needed. Use of iodine based CH₃-Br alternatives will require an understanding of the fate of iodine in soil systems. This understanding is needed to ensure proper management strategies, and to safeguard against any potential threats to public health and possible toxicity to plants and animals. In addition, I deficiency is still the number one preventable cause of mental retardation worldwide and many affected developing countries are beginning to add I to irrigation water supplies to offset these deficiencies. If this method of I supplementation becomes commonplace then it is necessary to understand the behavior of I in these systems in order to develop efficient and safe I supplementation plans.

Koenig

·Applied soil fertility studies continue. These include the following:

1. Potassium rate and application timing effects on alfalfa yield and soil test and tissue K.
2. Sulfur source and rate effects on alfalfa yield and quality.
3. Nitrogen rate effects on corn and small grain yield.
4. Rotation and soil fertility effects on long term crop yields and soil properties.
5. Banded phosphorus spacing for irrigated alfalfa production in calcareous soils.

The Utah Department of Agriculture and Food has recently expressed interest in devoting fertilizer checkoff funds to support limited applied soil fertility work and to publish updated fertility guides for major crops in Utah.

·In-house composting of poultry manure. This project involves composting poultry manure within high rise, caged layer facilities. The objectives include evaluating various bulking material types and rates, turning frequencies, and moisture management for in-house composting. A second phase of the project has focused on evaluating amendments to reduce ammonia volatilization from composting poultry manure. The project is funded by SARE with additional funding requested by US Poultry. Two manuscripts submitted and published to date.

·Irrigated grass pasture research. Utah continues to receive special project funding from USDA to conduct systems research on rotationally grazed, irrigated pasture. Fertility studies to develop nitrogen recommendations have been done. Additional studies on the spatial and temporal variability and fate of nutrients on pasture are ongoing. Many others are involved in this systems research.

·(C)AFO - a four letter word. Significant issues related to the operation and regulation of animal feeding operations in Utah. The federal EPA-NRCS Strategy for animal feeding operations was adapted by the Utah State CAFO Committee. This State Strategy calls for an assessment of all AFOs by 2003, identification and permitting of CAFOs 2001 - 2005, correction of unacceptable conditions by 2008. Educational programs to develop comprehensive nutrient management plans (CNMPs) began in 2001 with workshops and the publication of CNMP: A 12 Step Guide.

Significant issues related to AFOs and CNMP have been raised:

- Winter application of manure
- Mineralization rates and volatilization factors
- Phosphorus loading and soil test phosphorus limits
- Farm acreage- and/or watershed-based animal unit limitations
- Manure and soil testing (methods and frequency)
- Sustainability of small livestock farms
- Research, education, and cost-share program funding
- Role of various agencies in implementing the AFO Strategy

Programs from Utah State University:

- Agriculture Environmental Management Systems (AEMS) - J. Harrison
- Monthly satellite broadcast series on NMP/CNMP
- Extension and/or State publications such as the 12 Step Guide
- CNMP Training sessions (2001-2002)
- Altering soil and manure testing packages from USU Analytical Laboratory
- Research?

Kotuby-Amacher

USU Analytical Labs continue to operate on a cost-basis. We are hoping to do more research on methods. We are updating our webpage to be more user-friendly.

We are now doing manure analysis and offering new packages of soil analyses in association with CAFO efforts – through R. Koenig’s insistence.

We continue our work with the NAPT, Compost Analysis Program, and the US Golf Association Proficiency Testing Programs.

**Washington State University
WRCC-103 Nutrient Management and Water Quality
March 7, 2001**

David Bezdicek (bezdicek@wsu.edu)

We are looking at the dynamics of earthworm populations under direct seed conditions on Athena silt loam in a 4-year rotation for the NW Crops project at 7 locations in WA . Results show we are finding earthworms only at the Ruark site(Dayton) where there has been a long history of grass seed production and they favor certain crops like legumes and mustard.

In row-lime studies (with Greg Schwab, Ian Wildey (grad student) and Mary Fauci: Studies and grower's observation have expressed concern with decreasing soil pH, especially under NT. We hypothesize that in row application may be the only economical way to correct this problem. At two long-term NT sites near Pullman, we are looking at 2 lime sources (granulated from Pacific Calcium and beet lime from Moses Lake, 2 rates (100 and 200 lbs/ac) in combination with and without 16-20-0-15 starter. Urea at 100 lbs/ac is deep banded. This trial was started last fall in Winter wheat. Initial pH values (1:1)were in the low 5's and upper 4's. Initial extractable Al values were 16 and 20 ppm, close to the range where injury could occur. We are looking at pH, extractable NH₄ and NO₃, extractable Al, tillering, stand, and yield. Note that 16-20-0-15 is used by many growers as a starter, but this has an equivalent acidity requirement/neutralization of 5.5 lbs CaCO₃/ lb of N compared to 1.8 for most ammoniacal N fertilizers. Maybe we need to rethink the use of 16-20-0-15.

Craig Cogger and Any Bary (cogger@wsu.edu)

Use of yard trimmings in agriculture (with Dan Sullivan at Oregon State University). The objectives of this project are to characterize yard trimmings and determine relationships between yard trimmings properties and N availability.

Nitrogen availability from biosolids. We were part of a national study evaluating N availability from different sources of biosolids. We found that biosolids N availability in the PNW was about 30 to 35% in year 1 for biosolids produced by most processes. Lagoon biosolids had much lower N availability. Year 2 N availability was 5 to 10%.

Joan Davenport (jdavenport@tricity.wsu.edu)

Site Specific Crop Management as a Strategy for Reducing Nitrate Leaching Potential in the Columbia Plateau: The project goal is to evaluate and compare conventional and site specific fertilizer management strategies for nutrient management and develop recommendations for fertilizer management approaches to reduce the potential for nitrate leaching in irrigated row crop rotations.

Field Deployable, Real-Time Sensors for Early Detection of Crop Stress - Leaf and Canopy Reflectance: Work with both field and greenhouse grown potato and grape plants has indicated that the potential for using spectral reflectance for non-destructive monitoring for early crop stress detection is high. Preliminary spectral reflectance wavelengths specific to nitrogen stress and drought stress in potato and water and UV stress in grape (stresses responsible for the physiological disorder blackleaf) have been identified.

Soil Fertility to Improve Canopy Management in Grape: For a third growing season, a grape vineyard was intensively soil sampled (80 sample points, 2 depths in a 10 Acre vineyard) The samples were analyzed for plant mineral nutrients and soil texture and the field fertilized at variable rates based on soil test levels of N, P and K. Crop response to variable rate applied fertilizer is being evaluated as follows. In season monitoring used traditional soil and plant tissue (petiole, leaf blade) sampling and the more recent approach of monitoring soil nutrient flux with ion exchange resins.

Assessment of ion selective electrodes for nitrate and potassium measurements in soil slurries.:

Soil slurries of known volumetric water contents were directly applied to the surface of hand held ion selective electrodes (both pH meters and "Cardy" Meters for K, Na, NO₃-N) using both a silt loam and sand soil. Soil pH and K, Na, and NO₃-N were determined according to conventional soil test procedures and compared to ISE data. The soil pH meters worked well regardless of soil moisture content. The Cardy meters for K and NA worked in limited ranges and there was little consistency between soils and the Cardy NO₃-N meter did not work at all - like due to multiple ion interference.

Comparison of Slow Release and Conventional Nitrogen Fertilizers for Potato Production in the Columbia Basin: To compare slow release fertilizer to conventional soluble N fertilizer for impact on potato yield, quality and biomass production.

Bill Pan (wlp@wsu.edu)

1. Carbon and nitrogen cycling in direct-seed spring cereal alternatives to wheat-fallow (see 2001 WNM Proceedings).
2. Radar assessment and GIS modeling of cover crop adoption in the Columbia Basin for improving cycling and reducing wind erosion.
3. Trace metal accumulation in potato and wheat from commercial fertilizer sources.
4. Wheat and bluegrass straw utilization for paper and fertilizer production.

Bob Stevens (stevensr@wsu.edu)

A two year project looking at the effect of metal rates and sources on crop productivity and metal uptake in wheat and potatoes in cooperation with Bill Pan, Shiou Kuo and Jim Harsh is being finalized. See proceedings of WCC-103 meeting, March 2001.

A study has been initiated with the Grant County Conservation district to investigate the effect of BMPs for manure management on movement of Fecal Coliform and nutrients in return flows. The Washington State Department of Ecology is setting TMDLs for Fecal Coliform in irrigation return flows.

A project is being initiated with Brian Leib (WSU-Prosser) to look at BMPs to minimize sediment and nutrient loss from furrow irrigated fields. Various methods of handling tailwater will be used in fields where irrigation water has been treated with PAM.

WSU Publications

Sullivan, D.M., C.G. Cogger, A.I. Bary, and S.C. Fransen. 2000. Timing of dairy manure applications to perennial grass on well drained and poorlydrained soils. *J Soil Water Conserv.* 55:147-152.

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WCC-103
NUTRIENT MANAGEMENT AND WATER QUALITY
WYOMING REPORT
March 7, 2001

The dean of the University of Wyoming College of Agriculture resigned in the fall of 2000 and a search is currently underway to select a replacement.

A plan to restructure the UW Cooperative Extension Service had to be revised in 2000 because of negative reaction by clientele in several public meetings held around the state. The main objection was that a number of vacant county educator positions were not going to be refilled and remaining educators were to cover large multi-county areas. This plan was devised as a way to compensate for the shrinking CES budget and increasingly subpar salaries of UW CES educators. The revised plan calls for refilling some, but not all of the vacant positions. The interview process has been completed for at least two of these positions.

Two positions (Reclamation Ecologist and Water Quality Specialist) in the Department of Renewable Resources were filled. There are not other open faculty positions.

A cooperative project between the UW College of Agriculture and Northwest College (NWC) in Powell was begun in the fall of 2000 to offer four junior level Agroecology classes to NWC students. Classes in seed production technology and soil fertility have been, or are currently, being conducted. Classes in plant breeding and alternative ag production systems will be conducted in the future. The objective of the program is to offer students the convenience of remaining at a community college for an additional year to transfer to Laramie to complete the final year of the program. It is hoped that this program will increase the percentage of students that transfer from NWC to UW. The success of the program in terms of

undergraduate student numbers has been fair at best, but the program has produced a number of prospective graduate students to work with faculty located at Powell. Since the four courses offered can be taken for either undergraduate or graduate credit, it is more convenient for graduate students from northwest Wyoming to conduct research at the Powell R & E Center.

The biggest concerns in Wyoming agriculture are:

- 1) The future of the sugar beet industry
- 2) The high cost of fertilizer
- 3) Possible drought conditions this year and next

Extension Programs

Extension programs have generally focuses on one of the two following topics.

- 1) Nutrient Management Planning. University of Wyoming CES personnel have been working cooperatively with NRCS personnel to present workshops designed to educate producers on regulations regarding CAFOs and to outline the basic process for constructing a nutrient management plant.
- 2) Efficient fertilizer management. The recent skyrocketing of fertilizer prices has generated a great deal of interest among producers in reducing fertilizer inputs to compensate for increased costs.

Applied soil fertility research

Alfalfa. Because soil test K levels have been declining somewhat in many Wyoming soils, a preliminary study was initiated to verify current K recommendations for irrigated alfalfa. Effects of K source, rate, and application timing on both yield and forage quality are being evaluated.

Malt barley. A study will be initiated to investigate the interaction of variety, N rate and K fertilization on straw strength, lodging and disease incidence in barley.

Sugar beet. A small plot field study is being conducted to evaluate response to micronutrients and sulfur. This study includes fertilizer placement and timing variables.

A study is in progress to evaluate the effect of soil texture and temperature on seedling injury and stand loss due to preplant applications of urea.

A field scale study will be conducted to explore the potential of site-specific management techniques, including VR sidedress applications to increase N use efficiency and aerial photography to help delineate management zones.

Dry bean. A small plot experiment is under way exploring different N management options including timing, source and placement.

Future Research

Efforts are underway to design studies and procure funding for research on water quality issues related to fertilizer and manure use and to evaluate alternative practices that reduce dependence on synthetic fertilizers.

March 7, 2001

WCC-103 Annual Meeting
Salt Lake City, UT

Report
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Projects being prepared for publication:

Potassium response and dynamics in potatoes

Dairy Compost study

Active Research Projects:

Phosphorus in rainfall simulated runoff on calcareous soils
Ben Turner (postdoc), Dale Westermann, others.

Phosphorus in irrigation runoff vs. soil P availabilities & P sources
Dale Westermann, Kris Aase, Dave Bjorneberg

Phosphorus leaching losses and processes
Rick Lentz, Dale Westermann

Modeling sediment and P losses in surface irrigation
Bert Clemmens, Fedja Strelkoff, Dale Westermann, Dave Bjorneberg

Genetic control on Zn uptake and response in beans, *Phaseolus vulgaris* L.
Shree Singh, Dale Westermann