AW93-011

winter 1993-1994 we compared NO_3 in the soil surface of tilled and non-tilled soils under rye cover crop and fallow treatments. Estimates of soil solution NO_3 concentration based on AEM extracts ranged from 1 to 5 fold higher than concentrations based on soil extracts. Both measures indicated NO_3 availability declined during the winter. However, only the AEM based data identified statistically significant treatment effects; showing that the combination of fall tillage with winter fallowing increased soil NO_3 contents and led to more environmental exposure of NO_3 during the winter than reduced tillage or planting a rye cover crop alone.

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Irrigation and Nitrogen Fertility of Peppermint to Minimize Nitrate Leaching. A.R. Mitchell*, Oregon State University.

Peppermint is a high-value crop that generally receives liberal inputs of irrigation and nitrogen (N) fertilizer in the Northwest. The efficiency of N-fertilizer use is low--around 50 percent--hence, peppermint production has the potential to leach significant quantities of nitrate below the root zone. A three-year field study documented yield and NO_3 leaching under different rates of irrigation and N fertilizer using a line-source sprinkler design. Passive capillary samplers were installed beneath the root zone as a means to measure nitrate leaching. These were found to underestimate N leaching in our arid environment when compared to soil samples. Plant-response fertilization techniques were tested using a SPAD chlorophyll meter, stem NO_3 concentration, and soil inorganic N in a two-year study. The yield was compared against a 250 lb N/ac control.

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Nitrogen Management for No-till Corn and Grain Sorghum. W.L. THOMAS*, R.E. LAMOND, D.A. WHITNEY, L.D. MADDUX AND W.B. GORDON, Kansas State University.

Management of nitrogen (N) is critical in conservation tillage production systems where large amounts of residue are left on the soil surface. Research is ongoing to evaluate N rates and sources (urea, urea + NBPT, ammonium nitrate, UAN), a urease inhibitor (NBPT), and the effect of type of previous crop residue in continuously cropped no-till corn (*Zea mays*) and grain sorghum (*Sorghum bicolor* L.) and corn or grain sorghum in rotation with soybean (*Glycine max*). All N was surface broadcast. Yield responses to N were dramatic, although the biggest N response was with continuously cropped corn and grain sorghum. Urea and UAN performed poorly while ammonium nitrate and urea + NBPT produced significantly higher yields at many sites. These trends were apparent both in continuous cropped corn or sorghum and corn or sorghum in rotation with soybean. Chlorophyll meter readings correlated well with leaf N concentrations. Results indicate NBPT has good potential to increase efficiency of surface applied urea in high residue conditions.

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Zinc Fertility of Grain Sorghum. B.G. HOPKINS*, D.A. WHITNEY, AND R.E. LAMOND, Kansas State Univ.

Current zinc (Zn) fertilization guidelines are similar for sorghum and corn despite infrequent observations of deficiency in sorghum in several states. The purpose of this research is to define responsiveness of sorghum to Zn fertilization. Sorghum was grown in the greenhouse on 40 soils with a range of physical and chemical properties in the presence or absence of added Zn for dry matter yield and Zn uptake. Sorghum was also grown on two of these soils in the presence or absence of added Zn with and without the following amendments: phosphorus (P), calcium carbonate ($CaCO_3$), and combination P and $CaCO_3$. The soils were subjected to two different soil temperature regimes. Zn additions increased uptake, but yields did not increase for most of the 40 soils despite low levels of indigenous soil Zn in many of the soils as measured by DTPA extraction. Low soil temperature and P and $CaCO_3$ additions increased the incidence of lower dry matter yields and Zn uptake. This data indicates sorghum is tolerant of low soil Zn concentrations, however dry matter yield may increase when Zn is added under the following soil conditions: 1)sandy, low organic matter, 2)high P levels, 3)calcareousness, and 4)cool temperature.

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A Test of Relative-Yield Methodology for Pooling Data From Different Experiments. Q. PARIS*, Univ. of California, Davis, C.L. KREUZ, EPAGRI, Caçador, SC, Brazil, E.A. LANZER, Univ. Federal de S. Catarina, Brazil.

Ever since Mitscherlich introduced his exponential response function in 1909, agronomists have used the relative-yield methodology for pooling information derived from different experiments. Mitscherlich argued strenuously that, in his conjecture, response coefficients were constant over a wide range of soils and climates; only the maximum yield varied. These two conditions are necessary for a proper use of the relative-yield methodology. Over the years, the constancy of response coefficients has been rejected convincingly while the use of relative yields has continued untested. This paper develops and carries out a rigorous statistical test of the relative-yield methodology using three sets of sample information. In each case, the relative-yield specification is rejected in favor of alternative models of the von Liebig type that allow for more flexible interpretations of the experimental data.

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Nitrapyrin Response Variability Across a Sand Plain Landscape in Minnesota. G.L. MALZER*, T.W. BRUULSEMA, J.G. DAVIS, J.A. VETSCH, and P.C. ROBERT, Univ. of Minnesota.

Maize grain yield and grain N uptake response to anhydrous ammonia and the nitrification inhibitor nitrapyrin were evaluated in Minnesota in 1991 and 1992. Five rates of N fertilizer were applied with and without nitrapyrin as paired treatments in uniform transects (300-600 m by 8 m) across each field. Three blocks of ten treatments were evaluated. Grain harvest samples were collected at 15 m intervals along each transect. Nitrogen responses were analyzed with linear-plateau and quadratic-plateau models. Response parameters were estimated using a moving window approach on paired adjacent N-response replicates. Landscape models and soil condition maps were generated with muiltivariate regression using soil photographic tone and digital elevation model derivatives as covariates for soil total C, soil nitrate and mineralizable soil N. Landscape position and soil conditions specific to each pair of N-response replicates were compared to N-response parameters. Nitrapyrin provided both positive and negative yield response within each field and the response demonstrated spatial structure.

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PSNT and other methods for predicting nitrogen needs of silage corn in western Oregon. E.S. MARX*, N.W. CHRISTENSEN, and J.M. HART, Oregon State University

Calibration of the Pre-sidedress Soil Nitrate Test (PSNT) on western Oregon dairy farms was initiated to encourage efficient use of N from manure and fertilizers. The PSNT measures NO_3-N concentration in the top 30 cm of soil when corn (*Zea mays* L.) is at the 5 to 6-leaf stage. In a two-year study, corn silage yield and quality responses to supplemental N were measured in 28 experiments on 19 farms having a variety of manure application histories. A preliminary PSNT critical value of 21 mg NO_3-N kg^{-1} was estimated. Many growers prefer making fertilizer management decisions prior to planting and therefore may resist adoption of the PSNT method. Two potential alternatives to the PSNT were evaluated: 1) preplant concentrations of soil NO_3-N to 150 cm soil depth and 2) UV205 absorption of 0.01M $NaHCO_3$ extract from spring soil samples. Measurement of corn stalk nitrate concentrations at harvest was effective as a "report card" method of identifying sites where nitrogen was supplied in excess of crop needs. Data suggest that manure may supply a large percentage of required N on many dairies in the region.

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Nitrogen fertilizer use efficiency and the potential for water contamination from bare-root forest nursery production. J.R. THOMPSON* and R.C. SCHULTZ, Iowa State Univ.

A regional cooperative of state forest nurseries proposed a study in 1991 to assess the fate of chemicals, particularly N fertilizer, in 5 member nurseries. The approach taken at each of the nurseries included assessment of routine N fertilization (as per each nursery's protocol) compared with a control. Soil water samples were collected on a regular basis for the