MICRO-NUTRIENTS IN ALFALFA PRODUCTION: IS THERE NEED/OPPORTUNITY FOR COST EFFECTIVE MANAGEMENT?

G. E. Cardon, J. Barnhill, M. Pace, C. Israelsen, D. Miner, L. Greenhalgh, S. Banks, M. Shao, D. Rothlisberger, S. Olsen and P. Hole
Utah State University, Extension Soils Specialist, Logan, UT;
Weber County Extension Agricultural Agent, Ogden, UT

ABSTRACT

The management of soil fertility for optimum alfalfa productivity requires that all nutrient-related limitations be manipulated where warranted and cost-effective. It has been the policy of the Utah State University Analytical Laboratory to not promote soil testing for micronutrient sufficiency based on a lack of general need, historically, for nutrients such as sulfur, boron, zinc and others.

This study undertook to accomplish two things, 1) to provide an initial inventory of micronutrient levels in both soils and tissues under alfalfa production in northern Utah counties, and 2) to compare available tissue-based nutrient management guidelines from neighboring states and other prominent alfalfa production regions, to levels found to exist in northern Utah. This second objective was undertaken to begin to develop a set of tissue-based nutrient management recommendations for alfalfa in the state.

It was observed that deficiencies were found at the following frequencies: 13% for P, 16% for K, 8% for Ca, 8% for Mg, 3% for S, 16% for Zn, 0% for Fe, 5% for Cu, 18% for Mn, and 21% for B. Of the micronutrients, S and B were found to be deficient at the time of tissue sampling in 66% and 55% of sites, respectively. Soil test level deficiencies were also noted for P and K at a frequency of 29% and 37% of sites, respectively. For P, K and B there appears to be a soil-to-tissue level correlation for the mid-season samples. For S, the coincident mid-season soil test levels had no correlation to plant tisse deficiency. For the study sites, plant tissue deficiencies were noted in 10% or more of the sites for P, K and five micronutrients (S, Zn, Cu, Mn and B).

It would appear from this initial survey that there is definitive impetus for encouraging regular testing for micro nutrient deficiencies, particulary if plant performance is suspect under traditional, annual macro-nutrient management programs.

INTRODUCTION

The management of soil fertility for optimum alfalfa productivity requires that all nutrient-related limitations be manipulated where warranted and cost-effective. It has been the policy of the Utah State University Analytical Laboratory to not promote soil testing for micronutrient sufficiency based on a lack of general need, historically, for nutrients such as sulfur, boron, zinc and others. To prevent policy from pre-empting solid scientific, foundational evidence, it was determined necessary to re-evaluate the potential for micronutrient testing under alfalfa production.

Soil testing alone may not provide the best evaluation of need. Coupled soil and tissue testing provides a more complete determination of micronutrient levels affecting yield and performance of the plant and stand, but there has been little to no Utah-specific tissue analysis data available from which to establish appropriate nutrient management guidelines.

This study undertook to accomplish two things, 1) to provide an initial inventory of micronutrient levels in both soils and tissues under alfalfa production in northern Utah counties, and 2) to compare available tissue-based nutrient management guidelines from neighboring states and other prominent alfalfa production regions, to levels found to exist in northern Utah. This second objective was undertaken to begin to develop a set of tissue-based nutrient management recommendations for alfalfa in the state.

METHODS

Using the Utah State University Extension agricultural agent network, 38 sites in 10 northern Utah counties (Box Elder, Cache, Rich, Weber, Davis, Morgan, Salt Lake, Summit, Toole, and Utah counties) were identified, cooperation from the growers secured, and soil and tissue samples collected for analysis. Sites were chosen on established, mid age stands representative of stands, productivity and soils in each sampled county.

Composite soil samples and plant tissue samples were taken just prior to first cut of alfalfa from the selected fields. Our desire was to correlate tissue levels with coincident soil levels rather than to pre-season soil levels. Growers make in-season evaluations of crop condition, often desiring to correct deficiencies mid-season as they observe them developing. It was our intent to test whether mid-season soil tests would reflect the mid-season tissue levels of critical macro- and micronutrients.

Samples were submitted to the USU Analytical Laboratory for analysis. Twelve nutrient elements were tested, including P, K, S, Ca, Mg, B, Fe, Zn, Cu, Mn, Ni, and Mo. Soil S was analyszed as Sulfate. Soil B was determined on saturation and hot water extracts for comparison. Tissue nutrient levels were all determined by digest ICP analysis.

RESULTS AND DISCUSSION

Plant tissue levels were compared to table values of sufficiency from a number of sources gatherd from other western states, other soil testing labs, tissue testing review publications in the literature, fertilizer industry sources, and regional university and government agency publications. In all, twelve sources of alfalfa rissue adequacy levels were consulted and used to formulate thresholds for adequacy/deficiency for this study. This process resulted in the following thresholds for adequacy: 0.26% P, 2.0% K, 1.3% Ca, 0.25% Mg, 0.26% S, 21 mg/kg Zn, 30 mg/kg Fe, 25 mg/kg Mn, 5 mg/kg Cu, 30 mg/kg B and 1 mg/kg Mo. No definitive adequacy levels for Ni could be determined.

Using the above limits, it was observed that deficiencies were found at the following frequencies: 13% for P, 16% for K, 8% for Ca, 8% for Mg, 3% for S, 16% for Zn, 0% for Fe, 5% for Cu, 18% for Mn, and 21% for B. Of the micronutrients, S and B were found to be deficient at the time of tissue sampling in 66% and 55% of sites, respectively. Soil test level deficiencies were also noted for P and K at a frequency of 29% and 37% of sites, respectively.

For P, K and B there appears to be a soil-to-tissue level correlation for the mid-season samples. For S, the coincident mid-season soil test levels had no correlation to plant tisse deficiency. For the study sites, plant tissue deficiencies were noted in 10% or more of the sites for P, K and five micronutrients (S, Zn, Cu, Mn and B).

SUMMARY

The frequency of macro and micronutrient deficiency was an unexpected result, particularly for the high frequency of B deficiency in both the soil and plant tissue samples. A set of low soil

test B sites has been chosen to conduct a rate-response study for B in alfalfa to better evaluate the economic potential for B management in the state.

It would appear from this initial survey that there is definitive impetus for encouraging regular testing for micro nutrient deficiencies, particulary if plant performance is suspect under traditional, annual macro-nutrient management programs.

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Program Chair:
Grant Cardon
Utah State University
4820 Old Main Hill
Logan, UT 84322-4820
(435) 797-2278
Grant.cardon@usu.edu

Coordinator:
Phyllis Pates
International Plant Nutrition Institute
2301 Research Park Way, Suite 126
Brookings, SD 57006
(605) 692-6280
ppates@ipni.net