2010 Wisconsin Alfalfa Plant Analysis Survey

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Background and Justification

Over the past two years, field agronomists have been reporting to UW Extension County Agents and Specialists more cases of suspected sulfur (S) deficiency in Southern Wisconsin. This observation is born out by data from alfalfa samples submitted to the UW Soil and Plant Analysis Lab. In 2009, 85% of alfalfa samples submitted as abnormal looking were low in S (<0.25% S), while 44% of the normal looking samples were low in S (Laboski, 2009). This is an increase from 2008, where 67% of the abnormal samples were low in S and 29% of the normal samples were low. When both normal and abnormal looking samples are combined, 62% and 46% of all samples were low in S. In 2000 and 2001, Kelling et al. (2002) reported 38% of all samples had S contents less than 0.25%.

Wisconsin uses a sulfur availability index (SAI) to evaluate the potential for a crop to need S instead of using soil test S alone (Laboski et al., 2006). The SAI is composed of several factors including: soil test sulfate-S, an estimate of subsoil-S, an estimate of precipitation-S, soil organic matter, and available manure-S. The SAI was originally developed in the mid-1990s and was subsequently updated in 2005 using data from a 1999 through 2002 alfalfa plant analysis survey.

Atmospheric deposition of sulfate-S has been a historically important S source in Wisconsin and the Midwest. However, the amount of S being deposited by rainfall in Wisconsin has been decreased roughly in half from 2005 through 2008 (NADP, 2009) because of the reduction in industrial emissions. As air quality continues to improve, it is likely that sulfate-S deposition will continue to decrease, suggesting that S is going to be an important nutrient to apply and should be monitored. Indeed, increasing S deficiency in alfalfa in Northeast has recently been reported (Lang et al., 2006).

Potassium (K) fertilization of alfalfa had been declining in recent years because of the high cost of potash fertilizer. The K content of alfalfa samples submitted to the UW Soil and Plant Analysis Lab was low in 40% of all samples submitted in 2009 and 15% in 2008 (Laboski, 2009). Potassium is important for winter hardiness/stand longevity in alfalfa. Therefore increasing incidences of K deficiency are concerning in that the profitability of the alfalfa crop may be declining.

Generally the plant samples submitted to the UW Soil and Plant Analysis Lab come from Southwestern Wisconsin. Thus, it is unknown, how much the trends in alfalfa S and K content from samples submitted to the UW lab represent the State as a whole. Having a better understanding of the nutritional status of alfalfa across the state of Wisconsin is one component to assisting farmers in profitably producing a high yielding and good quality alfalfa crop.

The objectives of this survey were to: 1) obtain information on the nutritional status of Wisconsin's alfalfa crop; 2) determine if K and S deficiency are becoming more common

throughout Wisconsin or in certain regions; and 3) evaluate the effectiveness of the sulfur availability index in determining crop sulfur needs.

Materials and Methods

Alfalfa fields throughout Wisconsin were selected on the basis that they did not receive manure or fertilizer sulfur 12 months prior to sampling. Plant samples were collected, when plants are at the bud to 1st flower stage after 1st or 2nd cutting, from the top 6 inches from 30-40 plants and were composited. Samples were analyzed for total N and total mineral content. A 0 to 6 inch soil sample was collected at the time of plant sampling and consisted of 10 soil cores taken from the same area as the plant samples. Samples were analyzed for P, K, pH, buffer pH, organic matter, S, and B. The following information on field history was recorded: county, nearest town, latitude and longitude (if known); soil series; seeding date and variety; manure and fertilizer application history; previous crop history; number of cuttings in each year of the stand and annual yield (if available); date of sampling, and general appearance (with photo if possible) at the time of sampling

Results

Thirty-nine samples were collected from 19 counties in Wisconsin by University of Wisconsin-Extension personnel (Figure 1). Preliminary data analysis shows that K and S are the two nutrients about which growers should be most concerned. The sufficiency range for K is 2.25 to 3.5% K in the tissue; for S it is 0.25 to 0.5% S. For K, 51.3% of the samples had low K, while 48.7% of the samples had sufficient levels of K. For S, 64.1% of the samples had low S, while 35.9% of the samples had sufficient levels of S.

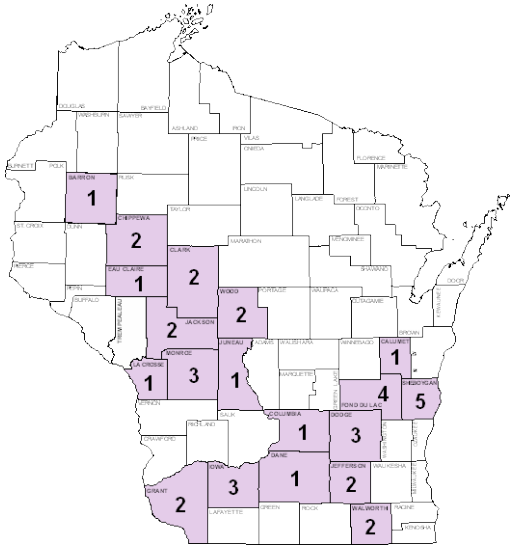

Figure 1. Location of alfalfa plant tissue samples collected in 2010.

The SAI has three interpretation categories: less than 30 is low, apply S; 30 to 40 is optimum, tissue test to confirm need; and greater than 40 is adequate, no S is needed. In this survey when samples had a low S tissue concentration, 36% of samples had a SAI less than 30, while 44% had an SAI between 30 and 40 and 20% of the samples had an SAI greater than 40. When samples had a sufficient S concentration, 14.3% had an SAI less than 30, 28.6% had an SAI between 30 and 40, and 57.1% had an SAI greater than 40.

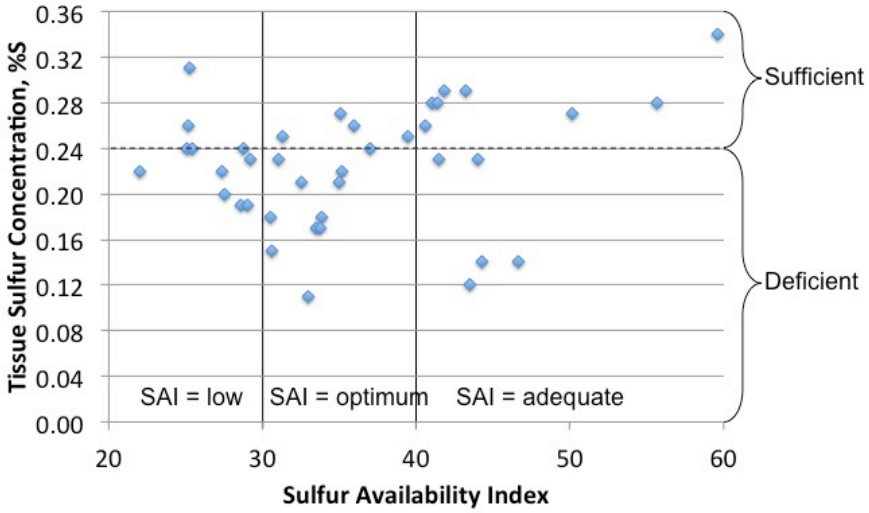

Figure 2. Relationship between tissue sulfur concentration and soil sulfur availability index for 39 samples collected in 2010.

Conclusions

These data suggest that the SAI may need to be updated because it is adequately predicting fields that are low in S. The continued reduction of S deposition is perhaps the main reason the SAI is not performing as well as expected. It is likely that growers will need to apply fertilizer S to alfalfa fields to maintain yield levels. The large percentage of samples that had low concentrations of K are not surprising considering that K applications to alfalfa were often less than UW recommended rates. The 2010 data set will continue to be analyzed. Samples will be collected again in 2011.

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