Survey of Sulphur Levels in Nova Scotia Soils

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The importance of sulphur (S) as an essential nutrient is often shadowed by an overall focus on nitrogen (N), phosphorus (P), and potassium (K), yet plants require S in amounts comparable to P for adequate growth. Sulphur is required to perform vital functions such as chlorophyll and protein formation, enzymes and vitamins development, cold and drought resistance and N fixation in legumes. Sulphur also adds colour, flavour and distinctive aroma to plants such as garlic, onions and cabbage. Sulphur for plant growth is taken mainly from two reservoirs, the soil and the atmosphere. Typically 90% of total soil S exists as organic S, and this must be mineralized, or converted to S by microorganisms, to be available to the plant. Sulphate is soluble in soil water, and in this form, plant roots can easily absorb the nutrient. Sulphur dioxide (SO_2) in the atmosphere also supplies S to plants.

In recent years, the threat of S deficiency in soils has intensified. Environmental regulations have lead to a reduction in air pollution, and although this is a positive change in terms of air quality standards, it follows that SO_2 inputs to soil through acid rain are reduced as well. Furthermore, since the mid-1960s, the use of high-analysis inorganic fertilizers containing less than 1% S has risen, especially following the introduction of triple superphosphate. The use of pesticides and fungicides containing S has been reduced as well. Historically, these were identified as the major sources of S for our soils. Intensive cultivation of S-deficient soils combined with projected further reductions in SO_2 emissions is expected to increase the occurrence of soil S deficiencies.

A survey of the S levels in 17 farms between Windsor and Annapolis Royal was conducted in the summer of 2010. In total, 443 soil samples were collected and managed by Jack van Roestel (AgraPoint). The results of the S analysis are presented in Fig 1. Most of these samples were from soils with forages, and had a history of manure application, which is a source of S. Despite this, the survey results show that sulphur levels are below the critical level (40 kg/ha) in 71% of the tested soils. It is also important to note that the assumed critical level of 40 kg/ha is not always adequate, as some crops require more S than the others (i.e. alfalfa, canola and Cole crops). The majority of the soils investigated in this survey are unable to efficiently support crops with high S demand, such as cabbage.

As a result of several years of soil S removal by plants without equivalent input, levels of soil S have dropped down to the point that the sensitive crops start showing visual S deficiency symptoms in the region, which may resemble symptoms of N deficiency such as pale leaf coloration. Sulfur deficiency can be recognized in some crops by yellowing of the youngest leaves. Crop-specific S deficiency symptoms include deformed, reddened leaves in cabbage, thin stems with light yellow leaves in wheat, reddened stems in potatoes, corn and alfalfa, and reddish-yellow leaves with seared tips in rutabagas.

On the global scale, S deficiency in agricultural soils has been reported with increasing frequency over the past twenty years. Due to the importance of reducing air pollution and trend towards greener farming practices, it is unlikely that S levels in soil will recover without a concerted effort by farmers and researchers to address this issue. Based on 2010 soil survey, it is clear that the time has come to start investigating the S requirements of important crops in Atlantic Canada, and to include S, along with N, P and K, in soil fertility recommendations. A better understanding of soil S dynamics combined with more efficient use of S sources such as manures, composts and fertilizers will benefit farmers growing high-S demand crop in this region. Some of the S options for growers are: gypsum (19%), elemental S (100%; low solubility), Sul-Po-Mag (langbeinite: $K_2Mg_2(SO_4)_3$; 22%), ammonium sulphate (24%), potassium sulphate (18%) and magnesium sulphate (13%).

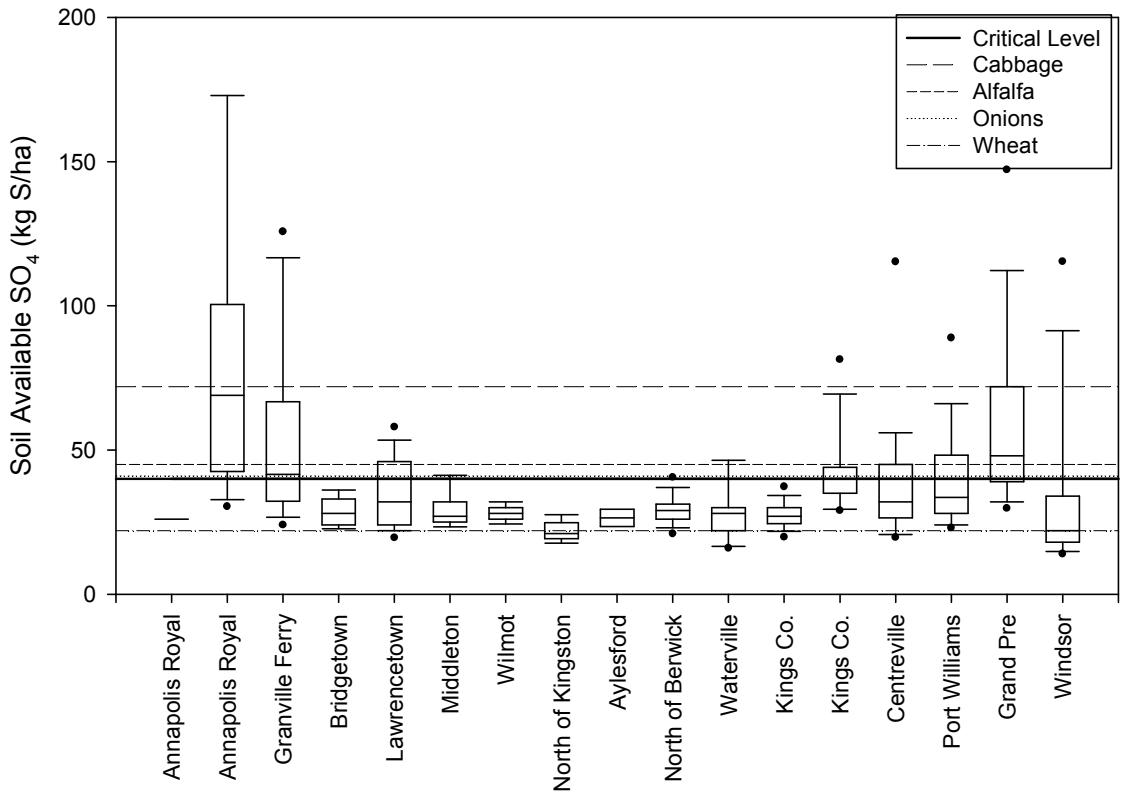

Figure 1: Results of the soil S survey conducted along an east-west transect in the Annapolis valley, Nova Scotia in the summer of 2010. The soil S requirements of select crops are also displayed. Over 70% of soil collected had S levels below the critical value of 40kg/ha. Soil available SO_4-S was extracted by Mehlich 3 extractant.