Sulfur and Selenium Application Rates Questioned

In a recent paper by Carter D. L., M. J. Brown and C. W. Robbins, “Selenium Concentrations in Alfalfa from Several Sources Applied to a Low Selenium, Alkaline Soil,” Soil Sci. Soc. Amer. Proc. 33:715–718, 1969, the authors conclude that the addition of BaSO₄ along with BaSeO₄ to give a S/Se ratio of 10 enhanced Se concentrations in alfalfa (Medicago sativa L.) particularly at the higher application rates. Total sulfur applied at the highest rate of selenium was 20 kg·ha⁻¹ yet the authors state that irrigation water supplies about three times the amount of sulfur required by alfalfa each year. Depending on the yield of alfalfa this could amount to an addition of 30 to 75 kg·ha⁻¹, considerably more than applied as BaSO₄.

I feel that before publishing this data the authors should have suspected an error or mix-up in the application of BaSO₄ and BaSeO₄ and repeated the study. Had the same or similar results been obtained then one could be confident of the results. Without the further data I could have no confidence in the results.

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D. R. WALKER

Soils Section, Research Branch
Canada Dept. of Agriculture
Lacombe, Alberta, Can.

In response to a question raised by D. R. Walker about one conclusion in our recent paper, Soil Sci. Soc. Amer. Proc. 33:715–718, 1969, we submit the following information:

All materials were applied in bands as explained in Materials and Methods. Therefore, both Se and S concentrations were many fold greater in these bands than in the bulk soil. Obviously, the reactions between compounds of the two elements are influenced by their concentrations. Furthermore, the S concentration was many times greater in the band than in the irrigation water which contained about 10 ppm S. Therefore, there would be little or no effect of the S in the irrigation water on the reactions within the bands.

The results were essentially verified in a companion paper by M. J. Brown and D. L. Carter, “Leaching of Added Selenium from Alkaline Soils as Influenced by Sulfate,” Soil Sci. Soc. Amer. Proc. 33:563–565, 1969. Significantly more Se was leached from columns receiving point applications of a BaSO₄-BaSeO₄ mixture than from similar columns receiving only BaSeO₄ at the same Se application rate. A saturated gypsum leaching solution removed more than did water, but the effect was evident with both leaching solutions. Several Sources Applied to a Low Selenium, Alkaline Soil,” Soil Sci. Soc. Amer. Proc. 33:715–718, 1969, the authors

Lime Requirements of Soils—Inactive Toxic Substances or Favorable pH Range?

The paper “Exchangeable Aluminum as a Criterion for Liming Leached Mineral Soils” by E. J. Kamprath in this issue of the SSSA Proceedings (34:252–254, 1970) is sure to raise questions in the minds of readers as to the appropriateness of continuing to lime soils to pH 6.5, which is commonly practiced in many agricultural circles around the world. The data in this paper indicate that on Oxisols the addition of 1.5 equivalents of exchangeable Al is sufficient for maximum yields of most crops. This amount of liming brings the pH to 5.6–5.7 and the exchangeable Al to 14% saturation of the cation exchange capacity. In another paper based on results of a study in Natal which is being processed for publication, maximum yields of a sorghum (Sorghum sudanense) test crop, only sufficient lime to lower the pH to 0.2 meq/100 g of soil is required. In this case, this was only 1/6 of the lime required to bring the pH to 6.8.

In general, lime recommendations in the Midwest region of the USA have been based on applying the amount of lime required to bring the pH to 6.5—a pH most favorable for plant growth. Until, approximately 6.5, but may be as low as 5.6, and as high as 6.8 for alfalfa (Medicago sativa L.). In the light of the above reports, is this an error? At first glance Fisher’s data (1969. Missouri Agr. Exp. Sta. Res. Bull. 947) suggests that yields of several crops were obtained in Missouri at a pH not one might expect. However, the pH’s he reported, when translated to the average pH’s he reported, when translated to the Midwest:

<table>
<thead>
<tr>
<th>pH in 0.01M CaCl₂</th>
<th>All Crops (avg)</th>
<th>All Crops, except wheat and cotton (avg)</th>
<th>Alfalfa (avg)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>5.3</td>
<td>5.5</td>
<td>5.7</td>
</tr>
</tbody>
</table>

Under present conditions of high rates of fertilization and high yields, the pH values reported by Fisher are for soils in 0.01M CaCl₂, an approximately 0.7 unit below those taken in the field. The pH values reported by Fisher are for soils in 0.01M CaCl₂, an approximately 0.7 unit below those taken in the field.