COMMENT AND LETTERS TO THE EDITOR

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 BaSO\(_4\) along with BaSeO\(_4\) 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 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, considerably more than applied as BaSO\(_4\).

I feel that before publishing this data the authors should have suspected an error or mix-up in the application of BaSO\(_4\) and BaSeO\(_4\) 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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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 BaSO\(_4\)-BaSeO\(_4\) mixture than from similar columns receiving only BaSeO\(_4\) 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. Saturated gypsum solution contains approximately 450 ppm S compared to 10 ppm in the irrigation water used in the field study, and the effect of applying the BaSO\(_4\) with the BaSeO\(_4\) was still evident when the saturated gypsum solution was used for leaching. Selenium that is free to leach through the soil is available for plant uptake.

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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 about the appropriateness of continuing to lime soils to pH 6.5 or 6.8 as is commonly practiced in many agricultural areas of the world. The data in this paper indicate that on Ultisols and Oxisols the addition of 1.5 equivalents of lime for each equivalent of exchangeable Al is sufficient for maximum yields of most crops. This amount of lime brings the soil pH to 5.6–5.7 and the exchangeable Al to an average of 14% saturation of the cation exchange capacity. Still another paper based on results of a study of Oxisols from Natal which is being processed for publication suggests that for maximum yields of a sorghum (Sorghum sudanense) test crop, only sufficient lime to lower the exchangeable Al to 0.2 meq/100 g of soil is required. In the latter case, this was only 1% of the lime required to bring the soils to pH 6.5.

In general, lime recommendations in the Northcentral region of the USA have been based on the concept of applying the amount of lime required to bring the soils to a pH most favorable for plant growth. Usually this pH is approximately 6.5, but may be as low as 6.0 for corn to as high as 6.8 for alfalfa (Medicago sativa L.). In the light of the above reports, is this an erroneous concept for the Midwest? At first glance Fisher’s data (1969. Missouri Agr. Exp. Sta. Res. Bull. 947) suggest that maximum yields of several crops were obtained in Missouri at lower pH than one might expect. However, the pH’s reported by Fisher are for soils in 0.01 M CaCl\(_2\), and such pH’s are approximately 0.7 unit below those taken in H\(_2\)O. Thus the average pH’s he reported, when translated to pH in water, are not greatly different from those generally recommended in the Midwest:

<table>
<thead>
<tr>
<th>Substance (avg)</th>
<th>pH in 0.01M CaCl(_2)</th>
<th>pH in H(_2)O</th>
</tr>
</thead>
<tbody>
<tr>
<td>All Crops (avg)</td>
<td>5.3</td>
<td>6.0</td>
</tr>
<tr>
<td>All Crops, except wheat and cotton (avg)</td>
<td>5.5</td>
<td>6.2</td>
</tr>
<tr>
<td>Alfalfa (avg)</td>
<td>5.7</td>
<td>6.4</td>
</tr>
</tbody>
</table>

Under present conditions of high rates of fertilization, sufficient electrolyte may be in the soil to give lower pH in water than that found to be necessary for maximum yields when lower fertilizer rates were applied.

Limited data from our laboratories suggest that when all nutrients are supplied in adequate amounts, maximum yields can be obtained at a considerably lower pH than when only the major (fertilizer) elements are added. It is common knowledge that in solution culture of plants, maximum yields can be obtained even at very low pH, if adequate amounts of all essential elements are present and no