CALCIUM AND MAGNESIUM DEFICIENCIES IN ALKALI SOILS

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It has been suggested that one of the possible causes of poor plant growth on soils highly saturated with exchangeable sodium is the inability of the plant to obtain an adequate supply of calcium. Ratner (4), using a Chernozem soil, studied the influence of various proportions of exchangeable sodium and calcium on the growth of oats and wheat in pot experiments. He found that these crops failed to grow at 60 to 70% sodium saturation and concluded that the inability of the crops to grow at this level of sodium saturation was due to a breaking down in the soil of the calcium regime, and in particular to an insufficiency of calcium as one of the elements of plant nutrition. Thorne (5), who grew tomatoes in mixtures of bentonite and sand having various ratios of exchangeable sodium and calcium, found that the yield and calcium content of this crop decreased markedly as the level of sodium saturation exceeded 40%. In agreement with the data of Ratner, this crop failed to grow at 70% sodium saturation. In the experiments of Ratner and Thorne it is difficult to explain plant failure on the basis of excessive alkalinity or unfavorable physical condition because the cultures had a pH value below 8.5 and contained a high proportion of sand in most cases.

The cultural media used by Ratner and Thorne contained no CaCO₃. On the basis of soil and plant analyses McGeorge (3) has suggested that the solubility and availability of calcium in alkaline-calcareous soils having a high pH value is low. Moreover, DiGleria (2) has shown that the solubility of CaCO₃ is greatly reduced as the pH value is increased above 8.5 by the addition of Na₂CO₃.

In a recent investigation of two unproductive alkali soils some data were obtained which tend to support the view that highly alkaline soils containing large amounts of exchangeable sodium may be calcium deficient. One of the soils studied also appears to be magnesium deficient.

The results of chemical analyses made on the soils and their saturation extracts are given in Table 1. Soil No. 535 is from the Yakima Valley, Wash., whereas soil No. 536 is from the Owyhee Irrigation District, Ore. The chemical data show that both of the soils have a very high pH value and are highly saturated with exchangeable sodium. Soil No. 536 is moderately saline, whereas soil No. 535

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3Figures in parenthesis refer to "Literature Cited", p. 727.

4Soils Nos. 535 and 536 were supplied by Dr. S. C. Vandecaveye, Washington State College, and Dr. R. E. Stephenson, Oregon State College, respectively.