THE DETERMINATION OF SOIL REACTION UNDER FIELD CONDITIONS BY MEANS OF THE SPEAR-TYPE GLASS ELECTRODE

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In cropping the irrigated semi-arid soils of the southwest there are two phases of soil chemistry which require almost constant attention. One of these is the salt concentration of the soil solution (white alkali) and the other is the hydroxyl ion concentration (black alkali). The two conditions are closely related if the soluble salts are in large part sodium compounds. White alkali soils, in which the clay is largely saturated with sodium, will be changed to black alkali soils by leaching out the soluble salts. Such conditions influence soil productivity by seriously affecting the normal development of the plant as well as the soil structure.

A number of investigators have called attention to the effect of hydroxyl ions on the absorption of certain essential ions by roots. The general opinion is that hydroxyl ions inhibit the absorption of negatively charged ions, notably phosphate and nitrate. In order to evaluate the reduced ion absorption it is necessary to know the pH of the soil under the growing conditions in the field. All methods now in use for the determination of pH in soils require too great a dilution of the soil with water. Since the hydroxyl ion concentration of alkali soils increases with dilution, the present methods yield only an arbitrary value which cannot be interpreted on a field basis. If the soil contains sufficient black alkali to be directly toxic, a pH determination at most any dilution will tell the story. In the border-line soils, that is those soils in which the hydroxyl ion concentration is not directly toxic but is sufficient to cause serious nutritional disturbances, there is need for greater precision.

The introduction of the spear-type glass electrode to methods of determining pH values prompted us to study its application to alkali soils as a means of determining the pH of the soil at field moisture contents. That is, the actual pH under which the plant must strive for a balanced nutrition.

METHOD

The method employed is extremely simple and requires little comment. Soils taken directly from the field, or air-dry soils to which varying amounts of water were added, were packed in small beakers and the glass and calomel electrodes were gently pressed into the moist soil. All the soils used were alkaline-calcareous soils which contain practically no organic matter.

1Contribution from the Department of Chemistry and Soils, Arizona Agricultural Experiment Station, Tucson, Ariz. Received for publication July 20, 1937.
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