A STUDY OF THE NEUBAUER AND WINOGRADSKY (AZOTOBACTER) METHODS AS COMPARED WITH A CHEMICAL METHOD FOR THE DETERMINATION OF PHOSPHATE DEFICIENCY IN WESTERN SOILS

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In connection with the sugar beet industry in the states of Colorado, Wyoming, Montana, and Nebraska, it has been necessary to develop quick and accurate methods for determining phosphate deficiency in the soils of the irrigated sections of these four states. During the past 4 years we have tried out most of the proposed methods and have tested 300 soil samples by the Neubauer method and over 10,000 samples by the Winogradsky method (Azotobacter). The Neubauer method has been used very extensively in Germany and—with the possible exception of the Mitscherlich method—is considered the most reliable as a substitute for field trials. Niklas in Europe and Sackett in this country have done much valuable work on the Winogradsky method, but data on actual comparisons between the two methods are extremely meager. As our experience with the Neubauer and Winogradsky methods has probably been more extensive than in the case of any other work done in the United States, both as to number and variety of soils gathered from very large areas, the results obtained should be of interest to soil investigators.

SOILS AND PROCEDURE

The soils tested from the four states mentioned range in pH from 7.1 to 9.1 and include sandy, sandy loam, and very heavy clay soils. Total nitrogen content averages 0.10% and the nitrate content (NO₃) ranges from 30 to 450 p.p.m. Practically all soils are rich in available potash, ranging from 30 to 80 mgm K₂O per 100 grams by the Neubauer method. The majority of them are rather deficient in P₂O₅, 70% falling in the classification of "very deficient" by both the Neubauer and Winogradsky methods.

The Neubauer method was the first to be used on a considerable