ELECTRODIALYSIS COMPARED WITH THE NEUBAUER METHOD FOR DETERMINING MINERAL NUTRIENT DEFICIENCIES IN SOILS

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In the literature are found several papers relative to the use of electrodialysis for extracting a portion of the cations from the soil solution. To mention only a few of these, one might refer to the work of Bradfield (1), Clark, Humfield, and Albens (2), Mattson (3), and Løddesol (4). The greater part of the work has been done to determine the total amount of electrodialyzable bases in the soil solution without subsequent determination of the amounts of the individual cations so extracted.

McGeorge (9), on the other hand, has reported that the process of electrodialysis is an excellent means of dissolving the active or available forms of phosphate from calcareous soils. The apparatus used by McGeorge was essentially that of Mattson, parchment paper being used as membranes at both cathode and anode. The somewhat similar three-chamber Bradfield cell was used in the work reported in this paper, although the anode membrane of parchment paper was replaced by one of collodion impregnated with hemoglobin, as described by Bradfield and Bradfield (5).

Since the Neubauer method for determining amounts of available phosphorus and potassium which soils contain, as described by Thornton (6), has come to be favorably regarded by certain workers, it was proposed to compare results secured by the Neubauer method upon certain soils with those secured by limited electrodialysis upon the same soils.

APPARATUS

Two Bradfield electrical dialyzers coupled in parallel (Fig. 1), were used in the determinations reported in this paper. The cathode membranes were parchment, while the anode membranes were collodion impregnated with hemoglobin. The soil in the middle chamber was kept in suspension by constant stirring. Preliminary work by the senior author had indicated that, in order to recover from a soil suspension an amount of cations closely approximating that available to plants, the soil should be subjected to electrodialysis for a period of 6 hours, using a direct current of 110 volts with an amperage of 3 to 5 milliamperes. Accordingly, the course dictated by these findings was adhered to, although previous trials with the hemoglobin-impregnated anode membrane had not been carried out. The dialysate was removed from the anode chamber, and the chamber refilled with water once each hour. The water supply was renewed at practically the same rate in the cathode chamber by means of inflow at the bottom and overflow at the top of the chamber.