sand is transported all the way south to the Grand Banks.

Besides the oceanographic work, a collection of plants was secured from the Torngat region of northern Labrador. This comparatively high range of mountains rises from four to six thousand feet directly out of the sea and is indented by several little known and very beautiful fiords. In the course of exploring these opportunity was had to learn something of the northern limits of the Atlantic salmon, and the southern limits of the Greenland char. Lastly, the expedition was able to contribute to the intensive studies of the cod now being carried out by the U. S. Bureau of Fisheries, by bringing back a series from northern Labrador.

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EXCHANGEABLE HYDROGEN AND SOIL REACTION

BASE exchange investigations have received much attention recently, and the procedures employed have been described in detail. Ammonium chloride has come to be the most commonly used salt for displacement of the alkalies and alkaline earths, while barium chloride is preferred for the determination of exchangeable hydrogen; the latter salt has recently been recommended for the displacement of all bases.

So far as the writer is aware, ammonium acetate has not been mentioned as a base exchange salt, but it seems to have some important advantages, which will be discussed.

It is a "neutral" salt, the ionization constants of ammonia and acetic acid being nearly the same, about 1.8×10^{-5} at 25°; both acid and base are very weak, hence the salt is a good buffer around the neutral point. The use of a neutral buffer solution for leaching the exchangeable bases from the soil appears to be the logical procedure. Without doubt exchangeable hydrogen obtained in the extracts is closely correlated with pH of the solution in contact with the soil, hence the amount of ammonia absorbed and the total absorbent capacity of the soil will depend upon the same factor. For this reason it would seem advisable to use a solution at some definite reaction in all cases. If such solution is neutral, the solvent effect upon soil minerals should be less than if it was acid. Ammonium acetate is completely volatile on the steam bath and is easily gotten rid of by simple evaporation without danger of loss, and without the use of nitric acid as required for the destruction of ammonium chloride. A normal solution of ammonium acetate at pH 7.0 is a good solvent for all the bases which may be expected to be concerned in soil work, including iron and aluminum, considerable quantities of which remain in the hydrosol condition in such a solution at ordinary temperatures. It will not dissolve these hydrated oxides from the soil, however, as ammonium citrate does, hence if they are found there is a strong presumption that they have entered the solution by true interchange; the buffer properties of the salt make it seem unlikely that the amounts of free acetic acid resulting from exchanged hydrogen would raise the H-ion concentration sufficiently to dissolve an appreciable amount of these elements, but which might very easily happen with ammonium chloride. A normal solution of ammonium acetate at pH 7 does not attack calcium carbonate to as great an extent as ammonium chloride does, although the solvent effect is not negligible. More organic matter is dissolved by the acetate than by the chloride, although the writer has never encountered any soil giving more than a straw-colored extract, nor had any difficulty from this source. Ammonium acetate is readily soluble in alcohol, permitting the use of this solvent for the removal of the excess salt from the leached soil, for the subsequent determination of the absorbed ammonia. Alcohol is better than water for the purpose, as it runs through faster, and there is no tendency for the ammonium absorption complex to break up in alcohol, as usually happens when washed with water.

Unfortunately, ammonium acetate is not obtainable in pure neutral crystals; the commercial salt is rather indefinite in composition, but always contains excess acid. A normal solution of the neutral salt is therefore best prepared by mixing equal volumes of carefully prepared twice normal acetic acid and ammonia, checking the reaction by means of the quinhydrone electrode and adding sufficient acid or ammonia to bring to exact neutrality and water to compensate for the contraction in volume occurring on mixing these strong solutions.

One hundred gram portions of soil crushed to pass 2 mm are percolated with 750 cc of the solution; according to the writer's experience, this volume is sufficient to remove the exchangeable bases from the silt loam soils so far investigated. The percolation is conducted in an apparatus so arranged that the solution is protected from the atmosphere, a point of importance if exchanged hydrogen is to be determined. This determination presents some difficulty, in consequence of the buffer properties of the salt. By a procedure of electrometric titration, however, excellent results have been obtained. The entire percolate is poured into an 800 cc Pyrex beaker, 0.5 g. quinhydrone added, and a comparison electrode vessel made from a thin test tube with fused-on siphon and stopcock, and containing some of the original acetate solution with a little quinhydrone supported in the beaker. Electrodes cut from the same piece of platinum foil are immersed in the solutions, and connected through a very sensitive galvanometer. The solution in the beaker is vigorously stirred by motor, while fifth normal ammonia is run in at a rather rapid rate until the galvanometer shows no deflection. By the adoption of a standardized procedure, it has been found possible to obtain consistent results on duplicate percolations made at different times. It is necessary to renew the solution in the comparison electrode vessel for each determination and to work rapidly, as the quinhydrone is quickly oxidized and the electrodes become polarized. The titrated solution is evaporated, organic matter gotten rid of by a careful ignition in the beaker and the subsequent separations made by standard methods. The alkalies are determined in the same solution after the magnesium, which is precipitated as arsenate, and the filtrate evaporated and ignited; the excess arsenate is entirely volatile with ammonium chloride. Needless to say, in this procedure it is necessary to use minimum amounts of pure ammonium salts only as reagents. The ignition in glass has not been found to result in any considerable contamination; the blank for potassium has always been found to be low, and while that for sodium is important and for calcium appreciable, the principal source of these impurities has been traced to the ammonia solution used for the preparation of the acetate.

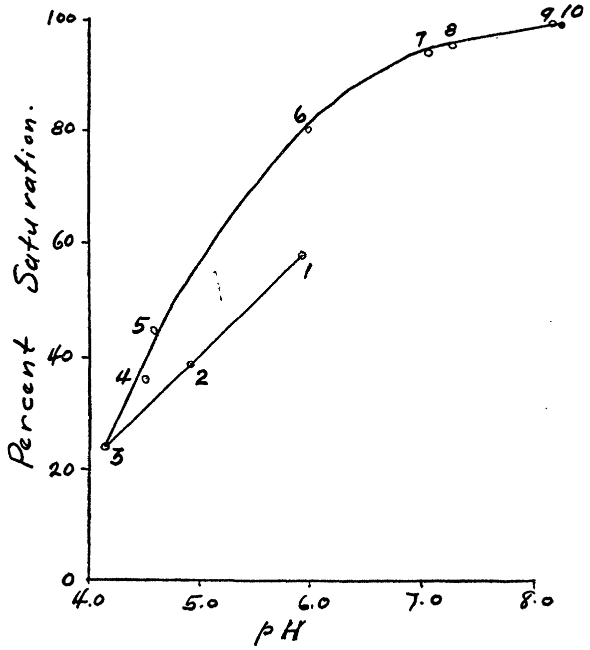

FIG. 1. The relation of degree of saturation to pH. The numbers refer to the various horizons.

The best criterion for general accuracy in these procedures is the excellent balance between the sum of milligram-equivalents of cations exchanged and ammonia absorbed by the leached soil. Surface soils sometimes show an excess of ammonia absorbed, possibly due to absorption of ammonium acetate as a whole by organic matter. Soils containing much carbonate show excess of base dissolved, which may be corrected for by determinations of carbonate in original soil and leached residue, best dried and finely ground for this purpose. Drying the leached soil prior to determination of absorbed ammonia is not permissible, as ammonia has been found to be lost.

In an examination of samples from a Clermont silt loam profile, a detailed description of which will appear elsewhere, an excellent correlation between percentage of total base absorbent capacity satisfied by neutral salt-forming bases and soil reaction has been discovered. This soil represents an extreme example of weathering *in situ* of a very old (Illinoian glaciation) calcareous till, the highly eluviated surface and subsurface horizons being acid and practically all carbonates leached out to the depth of eight or nine feet. The relation is shown graphically in the figure, degree of saturation being plotted against pH determined on 1:1 suspensions of dried soil and water, after 3 days standing for equilibrium to become established. The points are numbered according to order in sampling, 1 being surface soil and 10 the parent material, 108–120 inches, with over 25 per cent. carbonate. The figure shows that the first two horizons are less acid and more saturated than the third, and that beginning with the fourth horizon acidity decreases and degree of saturation increases as the parent material is approached. From the first to the third horizon the points are on a straight line, but points corresponding to lower horizons are all near a smooth curve with slope different from that of the line. The difference in slopes may indicate that there is a difference between base absorbents at the surface and below, perhaps due to the presence of organic matter.

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TUMORS IN KALE

DURING the past two years experiments have been made in an effort to induce tumors by artificial stimulation in kale plants. Three methods have been utilized, involving (1) the subjection of the entire plant to vapors; (2) subjecting localized areas of leaf sur-