ROTHAMSTED RESEARCH

Report for 1931

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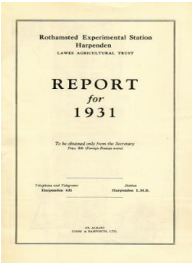

The Soil

Rothamsted Research

Rothamsted Research (1932) *The Soil ;* Report For 1931, pp 77 - 80 **- DOI: https://doi.org/10.23637/ERADOC-1-65**

THE SOIL

(Chemical and Physical Departments)

(*a*) Soil Classification

XXVI (A). E. J. Russell. "*Principles and Methods of Soil Utilisation with Illustrations from the British Empire.*" Proceedings of Second International Soil Congress, Russia, 1930.

XXVI (B). E. J. Russell. "*The Soil Resources of the Empire.*" Proceedings of a Conference on Soil Science Problems held at the Rothamsted Experimental Station, September 16th-18th, 1930. Imperial Bureau of Soil Science Technical Communication No. 17, 1931, pp. 23-28.

These two papers contain accounts of the methods by which the soils of the most important types in the Empire have been brought into cultivation and in many instances made to increase in productiveness.

A survey of the soil resources of the Empire is urgently needed in view of the important social and economic problems involved in further development and land settlement. Much progress has been made in mapping the soils of Australia, and material is being assembled in other parts of the Empire on which a preliminary survey could be based.

XXVII. E. M. Crowther. "*Soils and Climate.*" Ministry of Agriculture, Report on Agricultural Meteorological Conference, 1931, pp. 5-11.

Earlier work (*cf.* Report 1930, XXXI, p. 82) is briefly reviewed and supplemented by an analysis of the distribution of soil types in European U.S.S.R. in relation to climatic factors as measured by the mean annual rainfall and temperature. It was found that for points distributed at distances of about 70 miles over the area between 65° N. and 45° N. and 28° E. and 58° E. the soil type, as shown on Prassolov's map on the scale of 1 to 2,500,000, the values for an arbitrary index of climate (R—30 cms. $\div$ T + 4° C) fell within the following limits for 290 out of 318 points: Brown soils and alkali soils, negative; chestnut soils, 0 to 0.5; southern Chernozem, 0.5 to 1.0; ordinary Chernozen, 0.75 to 2.0; thick and Azov Chernozems, 1.0 to 3.0; degraded and leached Chernozems, 2.0 to 4.0; strongly degraded soils (secondarily podsolised), 2.0 to 4.0; podsolised, peaty podsolised, gley podsolised and bog soils, greater than 3.0. For the areas covered by seven of these soil types there were significant regressions of rainfall on temperature. The degraded Chernozems and the secondarily podsolised soils fell into the same climatic band and the distinction between these soils may therefore depend on the interval since the forest invaded the steppe. The graphs illustrating the above groupings and the form of the empirical relationship chosen show quite clearly that Lang's "Regenfaktor" (R$\div$T) fails completely to group climates in accordance with soils. The factor (3 cms. per °C) used to separate highly leached soils from all others agrees closely with that derived from American and other data in the earlier paper.

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(*b*) Mechanical Analysis

XXVIII. Erik Troell. "*The Use of Sodium Hypobromite for the Oxidation of Organic Matter in the Mechanical Analysis of Soils.*" Journal of Agricultural Science, 1931, Vol. XXI, pp. 476-483.

Freshly prepared solutions of sodium hypobromite may be used with advantage instead of boiling hydrogen peroxide in mechanical analysis by the pipette method. Soils containing manganese dioxide or large amounts of organic matter may be treated rapidly ; changes in the clay are minimised ; the reagents are cheaper and more stable, and the method allows further simplifications in technique.

(*c*) Physical Properties

XXIX. R. K. Schofield and G. W. Scott Blair. "*The Influence of the Proximity of a Solid Wall on the Consistency of Viscous and Plastic Materials. III.*" Journal of Physical Chemistry, 1931, Vol. XXXV, pp. 1212-1215.

In earlier work evidence was obtained that when clay pastes are forced through narrow tubes, the consistency of the material near the wall differs from that of the bulk of the material. A construction was developed for obtaining plastic constants referring to the paste in the central part of the tube, by assuming that the modified layer was of small thickness compared with the tube radius. A simpler and more complete treatment is now given which indicates that although the thickness of the modified layer may be appreciable, the original construction proposed still gives a close approximation to the true values of the material in bulk. The treatment has now been carried up to the limit of the present accuracy of the experimental methods.

XXX. R. K. Schofield and G. W. Scott Blair. "*Depth and Rigidity of Sediment in Flocculated Clay Suspensions.*" Transactions of the Faraday Society, 1931, Vol. XXVII, pp. 629-632.

An extension of experimental work on the phenomena of rigidity in weak clay suspensions, (Schofield and Keen, '*Nature*,' 1929, 123, 492) with reference to the rigidity and volume of the sediment.

The strength of the rigid structure depends on the exchangeable ions and the added salt, but the relationship is not at present understood. The volume of the sediment after flocculation of the clay with varying quantities of different ions seemed to depend only on the nature and concentration of the clay, suggesting that the measurement might be of use in soil investigations.

XXXI. Ashutosh Sen and C. H. Wright. "*The Electrical Conductivity of Aqueous Soil Suspensions as a Measure of Soil Fertility.*" Journal of Agricultural Science, 1931, Vol. XXI, pp. 1-13.

The increase, on standing, in the electrical conductivity of an aqueous extract of soil over its initial value serves as a qualitative measure of soil fertility (Atkins. Journal of Agricultural Science, 1924, 14, 198). Measurements were therefore made on old soil samples from the Rothamsted classical plots which have been taken

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and carefully preserved in sealed bottles at intervals since the early days of the field experiments. The increase in conductivity is highly correlated with the recorded crop yield of the season in which the given soil sample was taken. The correlation is shown to be an expression of the progressive decline in the fertility of the soil over the period of the experiment.

XXXII. Ashutosh Sen. *"The Measurement of Electrical Conductivity of Aqueous Soil Suspension and its Use in Soil Fertility Studies."* Journal of Agricultural Science, 1932, Vol. XXII, pp. 212-234.

The effects of season, cropping, manuring, and cultivation on the change in the electrical conductivity of aqueous extracts of soil, were studied, in view of the possible use of this measurement as an index of soil fertility.

There is practically no change in the measurements for unmanured plots of low yield.

The addition of easily decomposible organic material causes, in general, a marked increase in the measurement.

Continued fallowing has little effect.

For soil under permanent grass there are marked seasonal variations, and where comparisons are being made the soil samples should be taken at the same season and under comparable meteorological conditions, while for arable soils the most suitable time is after the soil is prepared for the crop, but before manures are sown.

(*d*) Physical Chemistry

XXXIII. J. K. Basu. *"Studies on Soil Reaction VII. An Electrodialysis Apparatus for the Determination of Replaceable Bases in Soils."* Journal of Agricultural Science, 1931, Vol. XXI, pp. 484-492.

A six-unit apparatus of two compartment cells is described and it is shown that the technique may be modified to exclude the kations from soluble salts from either the total bases as determined by direct titrations of the dialysate or from the individual bases as determined by analysis.

XXXIV. E. M. Crowther and J. K. Basu. *"Studies on Soil Reaction VIII. The Influence of Fertilisers and Lime on the Replaceable Bases of a Light Acid Soil after Fifty Years of Continuous Cropping with Barley and Wheat."* Journal of Agricultural Science, 1931, Vol. XXI, pp. 689-715.

At the completion of a 50-year cycle of continuous cropping with both wheat and barley on a light sandy soil at the Woburn Experimental Station, soil samples from all of the plots were analysed for replaceable bases.

The soil had little or no calcium carbonate originally and comparison with early soil samples showed that the unmanured plots lost about half of their replaceable calcium in the 50 years. The loss of calcium was much greater on plots with ammonium sulphate and the crops failed completely in about 20 years. Plots with sodium nitrate or farmyard manure retained considerably more calcium than the unmanured plots.

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The effect of superphosphate was so slight that for practical purposes it may be regarded as without effect on the replaceable bases.

The final replaceable calcium was reduced at the rate of 0.8 mol. CaO per mol. of ammonium sulphate added throughout the experiment, and increased at the rate of 0.5 mol. for the equivalent amount of sodium nitrate. The relatively low value for the ammonium sulphate effect is due to the low base content of the very acid soils and the low calcium bicarbonate content of the water. To increase the replaceable calcium of the ammonium sulphate plots to that of the sodium nitrate plots required 2.8 mol. of CaO per mol. of ammonium sulphate when the lime was applied at intervals of about 10 years. A rule is proposed for calculating the effects of various nitrogenous fertilisers on the lime content of the soil.

Most of the added lime was recovered many years later when the original lime content was low, but added lime was rapidly lost by leaching from soils of relatively high replaceable calcium content.

A new method was devised determining the " degree of unsaturation " or " exchangeable hydrogen " of soils. A mixture of soil and calcium carbonate is extracted with *N*.NaCl, and the difference between the calcium and the bicarbonate contents of the extract is taken as a measure of the replaceable calcium and hydrogen.

(*e*) Organic Chemistry

XXXV. M. M. S. Du Toit and H. J. Page. *" Studies on the Carbon and Nitrogen Cycles in the Soil. IV. Natural and Artificial Humic Acids."* Journal of Agricultural Science, 1932, Vol. XXII, pp. 115-125.

The preparation of natural humic acids from soil, peat (Dopplerite) and " Adco," and of artificial " humic " acids from sucrose, cellulose, dextrose and glycine (Maillard), hydroquinone and lignin, and their purification are described.

Their elementary compositions and their behaviours under conductimetric titration with ammonia have been studied. The artificial products from sucrose and furfural did not behave as acids but all the natural products, and the artificial products from cellulose, hydroquinone and lignin possessed the properties of colloidal acids.

Preliminary investigations into the " humification " of furfural and ω-hydroxymethyl furfural, and into the interaction of dextrose with amino bodies, are described.

SOIL ORGANISMS

(Bacteriological, Fermentation, General Microbiological, and Mycological Departments)

(*a*) Bacteria

XXXVI. H. L. Jensen. *" A Comparison of Two Agar Media for Counting Soil Micro-organisms."* Journal of Agricultural Science, 1931, Vol. XXI, pp. 832-843.

A statistical test was made of the variation between bacterial and actinomycete colony numbers on parallel plates on dextrose-casein agar, the medium used for the counts involved in the author's

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