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## Rothamsted Report for 1932

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### The Soil

#### Rothamsted Research

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(c) GENETICS

- XXVII. R. A. FISHER. "*The Social Selection of Human Fertility.*" (The Herbert Spencer Lecture, delivered at Oxford, June 8th, 1932.) Oxford: The Clarendon Press, 1932, 32 pp.

Lecture delivered at Oxford in commemoration of Herbert Spencer. It is argued that the existence of natural law and the reliability of scientific prediction has the same basis in the physical, the biological and the social sciences.

- XXVIII. R. A. FISHER. "*The Bearing of Genetics on Theories of Evolution.*" *Science Progress*, 1932, Vol. XXVII, pp. 273-287.

Lecture delivered before the Royal Society of Dublin. The biological phenomena of the recessiveness of mutations, of loss of vigour through inbreeding, and of adaptation to ensure cross-fertilisation, are interpreted as evidence that evolution is opposed rather than promoted by the mutations which occur.

- XXIX. R. A. FISHER. "*On the Evidence Against the Chemical Induction of Melanism in Lepidoptera.*" *Proceedings of the Royal Society, B*, 1933, Vol. CXII, pp. 407-416.

A method is given of assessing by calculation the value of evidence of the non-occurrence of recessive mutations under experimental conditions. It appears that the evidence against the induction of melanic mutations in moths by feeding with lead, is insufficient to disprove the existence of mutation rates up to 5 per cent. or 8 per cent., according to the stage at which mutation is postulated.

Mutation rates of this magnitude would be far greater than those which can be certainly induced by any other agency.

The use of back-crosses instead of inbreeding would increase the value of experimental data of this kind by approximately thirty-fold.

THE SOIL

(Departments of Chemistry, Physics and Statistics.)

(a) SOIL CLASSIFICATION

- XXX. L. L. LEE. "*The Possibilities of an International System for the Classification of Soils. Being a Consideration of the Influence of Geology and Climate on Soil Types. A Comparative Study of South-East England and Central New Jersey, U.S.A.*" *Journal of the South-Eastern Agricultural College*, 1931, No. 28, pp. 65-114.

An examination of the soils of South-East England, using the American methods of classification as modified for the New Jersey area of the United States. In both areas the soils occur in belts corresponding to the geological formations. Since geology has been the dominant factor in the soil formation of these areas, geological factors therefore receive first consideration in classifying the soils. Climatic factors have altered soil reaction more in Central New Jersey than in South-Eastern England, and, in general, podsolization is further advanced in the soils of Central New Jersey. A similar regional profile is developed in both districts, and consists typically

of A horizons which are lighter in texture than the B horizons overlying C horizons, which are heavy or light in texture, depending on the nature of the geological parent material. The textural relation between the A and B horizons is much more marked in Central New Jersey.

- XXXI. E. M. CROWTHER. "*Climate, Clay Composition and Soil Type.*" Proceedings of the Second International Congress (1930) of Soil Science, Commission 5, 1932, pp. 15-23.

The results of an earlier (*see* Report 1931, XXXI) statistical analysis of the composition and distribution of American soils in relation to climate are reviewed and similar methods are used to compare the distributions of soils in U.S.A. and U.S.S.R.

(b) MECHANICAL ANALYSIS

- XXXII. E. M. CROWTHER AND K. TROELL. "*Oxidation of Organic Matter in the Pretreatment of Soils for Mechanical Analysis.*" Proceedings of the Second (1930) International Congress of Soil Science, Commission 1, 1932, pp. 48-51, pp. 253-255.

A critical comparison of the hydrogen peroxide, sodium chloride and sodium hypobromite methods (*cf.* Report 1931, XXVIII).

(c) SOIL CULTIVATION

- XXXIII. B. A. KEEN AND G. H. CASHEN. "*Studies in Soil Cultivation. VI. The Physical Effect of Sheep Folding on the Soil.*" Journal of Agricultural Science, 1932, Vol. XXII, pp. 126-134.

The folding of sheep on light land is commonly believed to improve its tilth by the consolidating effect of the sheep hooves. This belief has been criticised on the grounds that the subsequent ploughing will destroy the consolidation. The matter was investigated in two stages. An instrument, based on the principle of the pile-driver, was used to measure the actual consolidation; the effect extended to a depth of 10 cm., the maximum compression occurring at 3-4 cm. The effect of subsequent ploughing was measured by passing the soil through a series of sieves of different mesh sizes, and it was found that the consolidation produced by sheep treading was not totally destroyed by ploughing, and further, it was still apparent five weeks later when the seed was drilled.

- XXXIV. H. JANERT. "*Die Anforderungen des Maulwurfdränverfahrens an den Boden.*" (Soil Conditions necessary for Mole Drainage). Transactions of the Sixth Commission of the International Society of Soil Science, 1932, Vol. A, pp. 163-176.

The object of mole-drainage is to remove rain-water as rapidly as possible from the surface of the soil, and for this to be achieved the drains must be stable. The drains can only be stable if:

- (a) The soil is heavy enough. This can conveniently be measured by the heat of wetting of the soil, which should exceed 4 cal./gram.;  
(b) The soil structure is stable. This stability is measured by the ratio of the percentage of particles of diameter less than 0.02 mm.

(as determined in the Kopecky elutriator) and the heat of wetting. If this value is below 8, the fine particles are sufficiently flocculated not to be re-peptised by water.

(d) PHYSICAL PROPERTIES

XXXV. B. A. KEEN. "*Soil Physics in Relation to Meteorology.*" Quarterly Journal of the Royal Meteorological Society, 1932, Vol. LVIII, pp. 229-250.

This paper was the Symons Memorial Lecture for 1932, delivered to the Royal Meteorological Society. It consists of an account of those physical properties of soil of interest to meteorologists, and its scope is sufficiently indicated by the following subject headings: soil classification in relation to climatic zones; soil temperatures; the soil atmosphere; soil moisture; soil cultivation.

XXXVI. G. H. CASHEN. "*Measurements of the Electrical Capacity and Conductivity of Soil Blocks.*" Journal of Agricultural Science, 1932, Vol. XXII, pp. 145-164.

An improved method has been devised for measuring the electrical capacity and conductivity of soil blocks at different moisture contents. While the phenomena are complicated, and depend on the nature of the electrodes as well as on the soil texture, there is evidence that the soil moisture passes through characteristic points. Two of these are identified with Atterberg's constants—the lower plastic limit; and the moisture content at which air enters the pores. The two lower moisture contents have not yet been completely identified, but one of them seems to be related to the shrinkage and cohesion behaviour of soil and the rate of evaporation of water.

XXXVII. R. K. SCHOFIELD AND G. W. SCOTT BLAIR. "*Rapid Methods of Examining Soils. I. Measurements of Rolling Weights.*" Journal of Agricultural Science, 1932, Vol. XXII, pp. 135-144.

A small cylinder of moist clay is rolled backwards and forwards between two plates by giving a reciprocating motion to the upper one. Weights are gradually added to the top plate until the cylinder just elongates. This weight is a measure of the weight required to deform the soil and is thus related to the agricultural property known as heaviness. The apparatus is suitable for other plastic materials besides soil, and accounts of it have therefore been published in other appropriate journals.

XXXVIII. J. R. H. COUTTS. "'Single Value' Soil Constants: A Study of the Significance of Certain Soil Constants. VI. On the Changes Produced in a Soil by Exposure to High Temperatures." Journal of Agricultural Science, 1932, Vol. XXII, pp. 200-202.

Measurements on the loss on ignition of four soils of different physical type are not affected by changes in the temperature of furnace, provided that the temperature is above 600°. Errors in the determination of the loss on ignition are of the order of 1 per cent. of the true value.

The loss in weight of the soils can be ascribed in the main to loss of free and interstitial water up to about 100°; to destruction of organic colloids between 100° and 250°; and to destruction of inorganic colloids at higher temperatures.

- XXXIX. J. R. H. COUTTS. " 'Single Value' Soil Properties: A Study of the Significance of Certain Soil Constants. VII. The Moisture Equivalent and Some Related Quantities." *Journal of Agricultural Science*, 1932, Vol. XXII, pp. 203-211.

The moisture equivalent has been measured (by a technique requiring only small quantities of soil) for a number of samples comprising Natal and Sind soils. It is concluded that while with the latter (alkaline and saline) soils the moisture equivalent gives valuable information, it adds little to the data obtained by other methods for the Natal soils. The xylene equivalent of the Natal soils has also been measured; from the moisture equivalent and the xylene equivalent, the imbibitional water can be calculated if the specific gravity of the soil is known.

Equations expressing the moisture equivalent and the xylene equivalent of the Natal soils in terms of their loss on ignition and mechanical composition are obtained, and the significance of the relative values of the numerical coefficients in these equations is discussed.

- XL. G. W. SCOTT BLAIR AND F. YATES. " *The Effect of Climatic Variations on the Plasticity of Soil.*" *Journal of Agricultural Science*, 1932, Vol. XXII, pp. 639-646.

The plasticity of a soil as measured by the flow plasticity (*Soil Science*, 1931, Vol. XXXI, p. 291) depends on the climatic history of the soil from which the paste is prepared. In general, soil has a higher plasticity in cold and dry weather than in warm and wet weather, thus affording independent evidence of seasonal fluctuations in the quantity of highly dispersed particles. Mechanical treatment of the soil, e.g. flattening and digging, did not produce any regular effect in comparison with the untreated soil, but the design of the experiment was not such as to enable the differences that were observed to be distinguished from the seasonal fluctuations.

(e) PHYSICAL CHEMISTRY

- XLI. E. W. RUSSELL. " *The Present Position of the Theory of the Coagulation of Dilute Clay Suspensions.*" *Journal of Agricultural Science*, 1932, Vol. XXII, p. 165-199.

A critical review: the influence of Brownian motion and mass motion of one particle group relative to another in causing collisions between suspended particles; the electro-kinetic potential and the absence of exact experimental methods of measuring it; the influence of electrolytes and non-electrolytes on the electrokinetic potential and the stability of suspensions; the influence of the type and amount of exchangeable ions on the stability of clay suspensions and their rapid flocculation in electrolyte media with special reference to the effect of secondary chemical reactions.

(f) ORGANIC CHEMISTRY

- XLII. H. J. PAGE. "*Studies on the Carbon and Nitrogen Cycles in the Soil. V. The Origin of the Humic Matter of the Soil.*" *Journal of Agricultural Science*, 1932, Vol. XXII, pp. 291-296.

The results so far recorded in this series of papers support the hypothesis that the humic matter of the soil is derived from lignin, and emphasise the importance of studying the part played by nitrogen in the formation of soil humic matter.

- XLIII. R. H. HOBSON AND H. J. PAGE. "*Studies on the Carbon and Nitrogen Cycles in the Soil. VI. The Extraction of the Organic Nitrogen of the Soil with Alkali.*" *Journal of Agricultural Science*, 1932, Vol. XXII, pp. 297-299.

The alkali-extraction of the nitrogen from soils of certain plots of the classical permanent experiments on Barnfield and Broadbalk, follows a closely similar course to the alkali-extraction of carbon from the same soils.

- XLIV. R. P. HOBSON AND H. J. PAGE. "*Studies on the Carbon and Nitrogen Cycles in the Soil. VII. The Nature of the Organic Nitrogen Compounds of the Soil; 'Humic' Nitrogen.*" *Journal of Agricultural Science*, 1932, Vol. XXII, pp. 497-515.

The nitrogen contained in purified preparations of humic acid obtained from Rothamsted soils cannot be eliminated by methods which would be expected to remove simple nitrogenous impurities. The distribution of nitrogen in the hydrolysates of these preparations of humic acid by hydrochloric acid resembles that in the hydrolysates of proteins. A mixture of egg albumen and artificial humic acid from lignin resembles soil humic acid in the behaviour of its nitrogen on treatment with chemical reagents or enzymes. In soil humic acid the combination of non-nitrogenous humic acid and protein is more intimate than that involved in the formation of a colloidal "salt" by the precipitation of two oppositely charged colloids.

- XLV. R. P. HOBSON AND H. J. PAGE. "*Studies on the Carbon and Nitrogen Cycles in the Soil. VIII. The Nature of the Organic Nitrogen Compounds of the Soil: 'Non-Humic' Nitrogen.*" *Journal of Agricultural Science*, 1932, Vol. XXII, pp. 516-526.

The nitrogen extracted from Rothamsted soils by alkaline solutions but not precipitated by subsequent addition of acid, is made up of 30-40 per cent. as peptides, 5 per cent. as free amino compounds, 12 per cent. as ammonia with the remainder as other, non-basic forms.