ROTHAMSTED RESEARCH

Rothamsted Report for 1932

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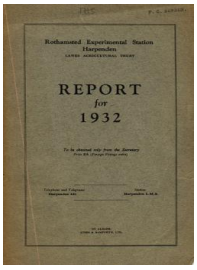

Chemical Properties of the Soil

Rothamsted Research

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Crumb formation in soils and its related phenomena are due to interaction between the clay particles and the water present, and methods are being developed to elucidate the details of this interaction. By comparing the properties of clays dispersed in water and in organic liquids it is possible to pick out those particular properties of the water and organic liquid molecules responsible for any given property of the dispersion. Thus crumbs can be formed from clay dispersed in the alcohols, aniline, and nitrobenzene, but not from clays dispersed in a hydrocarbon, indicating that their formation depends on the presence of an appreciable dipole moment in the molecules of the dispersion medium.

The methods for studying the plasticity of clay can be used equally well for studying the properties of dough, and this is being done by G. W. Scott Blair and R. K. Schofield. The way in which viscosity and relaxation time vary with stress and strain has been discovered, and efforts are now being made to test the constancy of the rigidity modulus under varying stress and the influence of the "stress-history" of the dough on the modulus. Certain aspects likely to lead to results of milling interest are being studied in conjunction with the Research Association of British Flour Millers.

THE SOIL: ITS CHEMICAL COMPOSITION AND PROPERTIES

The Chemical Department is concerned with the study of the composition of soils and of crops; it also does a great amount of analysis for other departments, particularly in connection with the field experiments.

The study of the soil has been greatly advanced in recent years with the development of ideas on the constitution of the clay fraction of the soil. The clay is now regarded as analogous to a salt, being made up of a basic and an acidic portion; it can interact with salts forming new clays differing from the original as a salt of one metal differs from the salt of another metal. The forces of attraction between the acidic part of the clay and the basic part, and the attraction between the whole complex clay and other substances, are now being studied by modern physico-chemical methods and relations hitherto unsuspected are being found between the chemical and physical properties of soil.

With this new knowledge it has been found possible to reopen many old problems, among them the question of soil analysis, which many soil chemists had given up in despair. Work on the exchangeable bases and the buffer capacities of soils has suggested means of overcoming the more serious defects of the older empirical methods of soil analysis and so giving analytical data which are constant for the soil concerned and do not depend, like the old figures, on the particular analytical procedure adopted. This work is facilitated by the steadily-increasing supply of soil samples from plots on which good field experiments have been carried out so that the response to fertilisers is known.

The Changes in the Soil Organic Matter

Hitherto the method adopted at Rothamsted for studying the changes in the soil organic matter has been to compare the quantities

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of carbon and of nitrogen present in soils at the beginning and at the end of a long period of field experiments.

A. Walkley has recently completed a survey of the Woburn soils showing the magnitude of the losses of carbon and of nitrogen. Some of his results are given in Table X.

TABLE X.—Changes in Carbon and Nitrogen content of Woburn soils during 50 years, 1876-1926.

	Unmanured.			*Complete Artificials* (Plot 6).		*Farmyard Manure* (Plot 11b).	
	1876.	1926.	Change in 50 years.	1926.	Change in 50 years.	1926.	Change in 50 years.
Barley Plots—							
Nitrogen per cent.	0.156	0.094	−0.062	0.109	−0.047	0.151	−0.005
Nitrogen, tons per acre	2.14	1.29	−0.85	1.50	−0.64	2.07	−0.07
Carbon per cent.	1.49	0.90	−0.59	1.07	−0.42	1.50	+0.01
Tons per acre ..	20.4	12.3	−8.1	14.6	−5.8	20.5	+0.1
Wheat Plots—							
Nitrogen per cent.	0.156	0.109	−0.047	0.104	−0.052	0.145	−0.011
Tons per acre ..	2.14	1.49	−0.65	1.43	−0.71	1.99	−0.15
Carbon per cent.	1.49	1.23	−0.26	1.07	−0.42	1.52	+0.03
Tons per acre ..	20.4	16.8	−3.6	14.6	−5.8	20.8	+0.4

A second method is now, however, being used by means of which the changes in oxidisable carbon and nitrogen during a single season can be followed. The effects of fallowing and of growing clover or rye grass are being studied and the method is being applied to find whether organic manures such as poultry manure have any special action in the soil. The method will also be used for studying green manuring.

THE BIOLOGICAL DECOMPOSITION OF ORGANIC MATTER

The decomposition of organic matter plays an important part in soil fertility and in the making and storing of farmyard manure; it is the process responsible for the purification of effluents from sugar beet factories, milk factories and others: considerable attention is therefore devoted to it in the Microbiological and Fermentation Departments. The earlier work has shown that in natural conditions the rate of decomposition of organic matter, as for example the rotting of plant residues, is limited by the amount of food available for the micro-organisms that bring it about. Usually there is insufficient nitrogen present, frequently also insufficient phosphate, and the decomposition proceeds more rapidly when more is added.

Rotting of straw. The first application of this general rule was to the rotting of plant residues, straw and similar substances to form an artificial farmyard manure. The process was so successful that it was handed over to the Adco Syndicate who have developed it on the large scale and applied it for use in many parts of the world; many thousands of tons of artificial farmyard manure are now made annually.

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