ROTHAMSTED RESEARCH

Rothamsted Report for 1932

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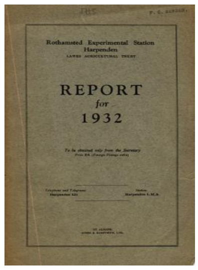

Biological Decomposition of Organic Matter

Rothamsted Research

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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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Investigations of the process, however, still proceed and much new information has now been obtained.

Of the various forms in which nitrogen was supplied for the rotting of straw, ammonium salts seemed to be the best in the early stages of the decomposition, although in the end they were no better than nitrate. When nitrate was used, however, any excess of nitrogen beyond what the organisms needed to effect the decomposition of the cellulose tended to be lost ; this did not happen with the ammonium salts.

Some of the products of the decomposition of straw and similar materials by the mixture of micro-organisms usually occurring on straw are very sticky when wet and possess considerable cementing power when dry ; these are formed during the making of good farmyard manure. Alkalinity is a necessary condition ; maximum stickiness is attained when the pH rises to 9.5 or 10, as happens when nitrate of soda is used as the source of nitrogen. The stickiness of a rotted manure may be increased by adjusting the pH to this value, and for this purpose sodium or potassium ions are more effective than calcium or magnesium.

The mixture of organisms contains both fungi and bacteria, but the fungi, while they can themselves decompose cellulose, produce no sticky substances ; the active agents appear to be bacteria which operate after the fungus attack and make the sticky substance from the fungus mycelium. The process is being further studied.

Purification of effluents. These investigations are made under the aegis of the Department of Scientific and Industrial Research. A purification process based on our knowledge of biological oxidation was worked out in the Rothamsted laboratories and developed to the semi-commercial scale at the Colwick factory. It is proving quite satisfactory in practice and has definitely shown that the discharge of unpurified effluents into rivers need not occur.

The purification of effluents from milk factories is being attempted on the same general lines as for the sugar beet effluents but modifications are necessitated by the fat which is always present, and which leads to clogging of the filters. Various methods are being tried to overcome this difficulty.

PLANT PATHOLOGY

The department of Mycology suffered a severe loss in 1932 when Dr. W. B. Brierley, who had had charge since its inception in 1918 and had developed it to a high state of efficiency, left it to take up the Professorship of Agricultural Botany at Reading University. Further loss occurred a few months later when Dr. R. H. Stoughton, who had been in charge of investigations on bacterial diseases of plants, was appointed Professor of Horticulture in the same University.

The Lawes Trust Committee decided to reorganise the department and reconstitute it as a Department of Plant Pathology with Dr. Henderson Smith as Head.

During his fourteen years service at Rothamsted Dr. Brierley devoted much attention to the genetical analysis of the fungus