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OSWALD SCHREINER & HOWARD S. REED

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MILTON WHITNEY, *Chief.*

THE RÔLE OF OXIDATION IN SOIL FERTILITY.

BY

OSWALD SCHREINER AND HOWARD S. REED.

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LETTER OF TRANSMITTAL.

U. S. DEPARTMENT OF AGRICULTURE,
BUREAU OF SOILS,
Washington, D. C., September 22, 1908.

SIR: I have the honor to transmit herewith the manuscript of a technical paper entitled "The Rôle of Oxidation in Soil Fertility," by Oswald Schreiner and Howard S. Reed, of this Bureau. This article embodies the results of work carried out in the Bureau and contains important information on some little-understood factors involved in the study of soil fertility. The facts here presented emphasize the beneficial effects of tillage and other practices conducive to thorough aeration of the soil, although the present study has been mainly along the line of oxidation processes in the soil, induced by the roots of growing crops.

The oxidation by roots of crops growing in the soil is an agent in soil improvement which has until recently been almost overlooked. The mild but effective oxidation produced in this way is shown to have a very appreciable effect in aiding the decomposition of organic matter in the soil. The importance of the organic constituents of the soil, as shown by our recent investigations, makes these results especially interesting, and the material throws additional light upon the question of soil fertility. In accordance with your suggestion the manuscript has been gone over carefully with Assistant Secretary Hays, who authorizes me to state that he concurs in my recommendation for its publication. This will form No. 56 in the series of bulletins of the Bureau of Soils.

Respectfully,

MILTON WHITNEY,
Chief of Bureau.

Hon. JAMES WILSON,
Secretary of Agriculture.

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THE RÔLE OF OXIDATION IN SOIL FERTILITY.

INTRODUCTION.

Oxidation is one of the most important processes in the soil, and while well recognized in the practical tillage of soils, the process itself and the forces which tend to promote oxidation have not been well understood nor much studied. Oxidation in soils may be produced by several different agencies, among which are the following:

Changes brought about by purely chemical processes in which the oxygen in the air attacks the soil compounds, producing higher oxidized forms. In this class should be included the interaction between chemical individuals of the same kind, resulting in the oxidation of one at the expense of the other—the process technically known as auto-oxidation. To this also should be added the influence of agents in the nature of fertilizers which have oxidizing properties, such as manganese or ferric compounds, nitrates, etc., as well as those which by changing the reaction of the soil increase the direct oxidation by atmospheric oxygen and oxidizing agents, which usually takes place more readily under alkaline conditions. The nascent production of nitric acid in the soil may also be a factor in the direct chemical oxidation of soil compounds.

Bacteria and the oxidizing enzymes which they produce are known to play an important part in oxygen fixation in soils, especially those relatively rich in organic matter, although the chemistry involved has not been extensively investigated and is but little understood.

The plant roots and the oxidizing enzymes produced by them in the soil constitute other agencies of oxidation which until recently were almost overlooked and even unknown. The mild but effective oxidation produced in this way by the roots of the growing crops and enzymes in the soil has a very appreciable effect in altering some of the soil constituents, and thus influencing soil fertility, through the action of added fertilizers and systems of rotation on this oxidizing power.

The present paper[a] embodies a series of studies upon the oxidizing powers of plant roots grown in aqueous extracts of soils and in

[a] The authors wish to acknowledge the valuable assistance rendered by Mr. J. J. Skinner, of this Bureau, in carrying out many of the experiments reported in this bulletin.