A COMPARISON OF THE ORGANIC MATTER IN DIFFERENT SOIL TYPES.

By Frank K. Cameron.

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In a former paper[1] the general problem of the organic matter in soils and subsoils was discussed and a method for the determination of the total organic matter was described, which experience has shown to be a reliable one. This method has been in use in the laboratories of the Bureau of Soils for some time, and many analyses have been made in connection with the mechanical analyses[2] of soils as carried out in the laboratories of the Bureau, for the purpose of assisting in the classification of the soils into types. During the past two years a total of 2,560 samples have been analyzed, and a corresponding number of organic determinations made by this method.[3] These analyses comprise the data obtained from 1,340 samples of soil and 1,220 samples of subsoil, covering 237 types of soil. The average content of organic matter for all these samples is 2.06 per cent. for the soil and 0.83 per cent. for the subsoil, showing, as would be expected, a much larger amount of organic matter in the soil, where the principal root development is and subsequent decay takes place, than in the subsoil. The artificial incorporation of organic matter in manuring has no doubt an influence in this same direction. There have been individual cases in which this order was reversed, that is, the subsoil showed a higher percentage of organic matter than the soil. The laboratory results were, in such cases, always in agreement with the field observations, which further showed that these lands were alluvial in character and that a deposit less rich in organic matter had been formed over what was originally the soil.

An examination of the results seem to indicate that, generally speaking, the range of color of the soil within any given soil type varies in the order of the content of organic matter. The color of a soil, however, is by no means a safe indication of its content of organic matter. It is obviously impossible to compare a brown or black prairie soil of the Middle West with a reddish soil, such

[1] This Journal, **26**, 29 (1904).

[2] Bulletin No. 24, Bureau of Soils, U. S. Dept. of Agr.

[3] The results will be found in the Reports of the Field Operations of the Bureau of Soils for 1902 and 1903.

as the Cecil clay which covers extensive areas on the Piedmont plateau. The color of the soil is influenced by the mineral components, and the same amount of organic matter in the red Cecil clay does not have the same effect in darkening the soil as in the case of the prairie soil. In the Cecil clay as a type, however, the color gradation goes with the organic content, and this is also true of the black to gray soils of the prairie regions. Marked differences between types are noticed in which the color is absolutely no indication of the amount of organic matter present. Thus a sample of the Hagerstown shale loam, with 4 per cent. of organic matter, is still a light-colored soil, whereas Marshall loam, with the same or even a less amount of organic matter, is a very dark soil. These observations indicate very strongly that not only has the mineral matter an important part in determining color, but further, the organic matter in different soils is of a widely different nature, not only in the extent of the decomposition which has taken place in it, but in the character of that decomposition. Much of the difference is brought about by differences in drainage conditions, the better drained soils being more frequently light in color while the darker soils usually owe their color to a different decomposition of the organic matter produced by present or past conditions of excessive moisture. There seem to be tendencies in some soils to decompose the organic vegetable remains in such a way as to make dark-colored soils, whereas other soils, though containing as much as 3 or 4 per cent. of total organic matter, are still light colored soils, although decomposition has gone forward as in the other soils. It is possible that in these different kinds of organic matter, or in the causes which produce these differences in the different soils, may be found the explanation of the beneficial effects usually ascribed to organic matter in its action on the crop, either by its correcting influence on the absorption of mineral nutrients by the plant, its effects on the mechanical and moisture conditions of the soil or by a direct physiological influence on the functional activities of the plant itself.

It has been said that these determinations of total organic matter were made in connection with the mechanical analyses of types. An examination of the large number of results obtained shows, however, very clearly that the total amount of organic matter is not in general a characteristic of type relations. There

are, of course, some very broad and general relations, certain soil types running low in organic matter, while others, such as the Marshall, Portsmouth, and Yazoo series, run consistently high, but all these latter soils are, or were recently, in a more or less swampy condition with a large accumulation of organic matter. The general result is, however, that the variation in the total organic matter in different samples of the same soil type is fully as great as between samples of different types. For instance, the Norfolk fine sandy loam, a pale yellow or gray sandy loam, has from 0.3 to 3.0 per cent. organic matter, while the Porters sandy loam, a grayish yellow sandy loam, and of but little finer texture, contains from 1.0 to 7.7 per cent. organic matter. but the Orangeburg clay, a red loam or clay loam, contains from 0.6 to 3.4 per cent., the Hagerstown clay, also a red clay or clay loam, contains 0.7 to 3.7 per cent., while the Hagerstown loam, a distinctly easier soil to till, and brown or yellow in color, contains 0.5 to 3.1 per cent. organic matter.

For these reasons the Bureau of Soils proposes in the future to omit the determination of the total organic matter as a regular integral part of the mechanical analysis of a soil, except in special cases when it is obviously of importance in defining a type. It will, of course, continue to make such determinations in individual areas for the purpose of studying the influence of organic matter on the management of the soil and its crop-producing power, and similar investigations involving more or less local peculiarities within any given type.

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SIZING PAPER WITH ROSIN SOAPS.

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IT has been the general practice until recent years for papermakers to use an excess of soda-ash or other alkali in saponifying their rosin for size-making. They have been very careful that there should be no free rosin in their size, lest rosin specks should appear in the paper, stick to the rolls and cause other annoyances. The popular belief has been that the alum simply precipitates the rosin and that it was the rosin which sized the paper.