INFLUENCE OF ORGANIC MANURES ON THE CHEMICAL AND BIOLOGICAL PROPERTIES OF ARID SOILS

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It is not an uncommon thing in the arid west to find soils containing in the surface-foot section sufficient potassium for the production of maximum crops for from 500 to 1,500 years, sufficient phosphorus for from 100 to 500 years, and sufficient nitrogen for only 30 to 50 years. Moreover, the second, third, and subsequent feet are equally rich in phosphorus and potassium, whereas the greater portion of the nitrogen is in the surface-foot section. Due to their scant vegetation and also to the rich, active, cellulose-decomposing ferments of the soil, their organic carbon content is low. Consequently, the great problem which confronts the tiller of these soils is two-fold, viz., the supplying of nitrogen in sufficient quantities to meet the needs of the growing crop and not only to maintain but actually to increase the organic carbon of the soil. The quantity and nature of the organic material present determines the tilth, the water-holding capacity, the speed with which the essential plant foods are rendered available, and also the nitrogen supply of the soil. For these reasons we have given considerable attention to the influence of organic manures upon the chemical and biological properties of arid soils.

The principal investigations have been conducted on two soils. The first is typical dry-farm soil on the Nephi experimental dry-farm located about 5 miles south of Nephi on the north slope of the Levan Ridge. The soil has been derived from the weathering of the adjacent mountain ranges. These mountain ranges contain deposits of phosphates, potassium, and large quantities of gypsum. The soil of the farm is a clay loam and contains in the surface-foot section 4,100 pounds of nitrogen, 86,000 pounds of potassium, 7,000 pounds of phosphorus, 42,000 pounds of organic carbon, 69,000 pounds of magnesium carbonate, and 139,000 pounds of calcium carbonate.

The second soil is typical irrigated soil on the Greenville experimental farm located at Logan. This is a very productive calcareous loam of sedimentary origin, the surface-foot containing 4,900 pounds of total nitrogen, 2,700 pounds of total phosphorus, 60,000 pounds of total potassium, 434,000 pounds of acid-soluble calcium, and 132,000 pounds of acid-soluble magnesium.

These soils have been studied under laboratory, greenhouse, and field conditions during the past 15 years as to number and kind of bacteria, bacterial activities, nitrogen, and carbon content. The average for the number of bacteria, ammonifying, nitrifying, and nitrogen-fixing powers of the soil as determined on the field soil is given in Table 1. The virgin soil in each case is taken as 100%.

1Paper read as a "discussion" of Dr. Waksman's paper in the symposium on "Soil Organic Matter and Green Manuring" at the meeting of the Society held in Washington, D. C., November 22, 1928.
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