THE RELATION BETWEEN SOIL REACTION, EROSION, AND AGGREGATION OF SILT AND CLAY IN CLARKSVILLE LOAM

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WHILE studying the effect of soil reaction on the growth and composition of annual flowers, Shear (16) observed that the more acid plats of Clarksville loam were undergoing severe erosion. Fig. 1 shows the eroded condition of one of the most acid plats.

The role of calcium in the formation of water-stable aggregates in the soil is controversial. Bradfield (4, 5) found that the coagulating value of a colloidal clay varied widely with slight changes in H-ion concentration. Reporting on the relation of exchangeable cations to the physical properties of soils, Baver (1) concluded that H-saturated soils were always less flocculated than the original untreated soil and that hydrogen flocculated the coarser particles but had a peptizing effect on the colloidal material.

More recently these investigators have pointed out some of the limitations of calcium in producing a desirable soil structure. Baver (2) stated that factors other than Ca-ion saturation are dominant in causing stable aggregation and Bradfield (6) pointed out that the formation of water-stable aggregates is much more than flocculation of colloids.

Greenhouse and laboratory investigations by Peele (12, 13), Lutz (9), and Browning (7) show that calcium in itself plays a minor role in improving the structure of heavy-textured soils. Metzger and Hilde (10) found that liming improved the aggregation of a silt loam soil which had an original pH of 5.7 when followed by a growth of sweet clover or red clover but had no beneficial effect on the aggregation of unleached fallow soil in the greenhouse. It is generally conceded that an interaction of factors may be responsible for the flocculation, granulation, and aggregation of soil colloids.

DESCRIPTION OF AREA AND PLAT TREATMENTS

The five 1/40-acre plats of Clarksville loam used in this study were remarkably uniform in texture and had an original pH of 5.3. The 5 to 7 inches of yellowish-gray loam surface soil were underlain by a brownish-yellow, friable clay loam. Elevation readings showed the micro-relief of the area to be very uniform with 8.7% slope to the southeast. The treatments of the plats selected and the resulting pH, along with the textural composition of the surface soil are shown in Table 1.

Ground limestone and Al(SO₄)₃ were applied at the indicated rates to the surface of these plats. They were plowed several times during the summer of 1933 and subjected to clean cultivation of annual flowers for the next three years. Small grain cover crops were seeded in the fall of 1933 and again in 1935. A rye...