

EFFECT OF AGGREGATE SIZE AND GYPSUM ON INFILTRATION RATE OF A SODIC CLAY SOIL¹

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The effect of aggregate size (<1 cm, 2-4 cm), sodicity level (13.8%, 23.9%) and phosphogypsum on the infiltration rate (IR) of a clay soil irrigated with distilled water (simulating rainfall) was studied with the use of a rain simulator under field conditions. The effect of adsorbed sodium on the amount of water which is required to reach an infiltration rate of 20 mm/h (this criterion was arbitrarily chosen for comparison purposes) is more pronounced for the larger aggregates than for the smaller ones. Although this amount of water is affected by both the aggregate size and exchangeable sodium percentage (ESP), the steady state IR is dependent mainly on ESP. The steady state IR was 1.5 and 4.0 mm/h for the soils at ESP 23.9 and 13.8, respectively. The effectiveness of phosphogypsum in the larger aggregates system was less than that in the smaller aggregates. The amount of water which is required to reach an infiltration rate of 20 mm/h for the soil with aggregates <1 cm (treated with gypsum) was much higher than that required for the same soil without gypsum (at both ESPs), whereas only a small effect was found for the soil with the larger aggregates (2-4 cm). Phosphogypsum was very effective in increasing the steady state IR of the soil. The average value of the gypsum-amended soil at ESP 13.8 was 14.3 and 11 mm/h for the smaller and larger aggregate systems, respectively, compared with 4.2 mm/h for the control at the same ESP. A similar effect was found for the soil with ESP 23.9 but the steady state IR was much lower (11.6 and 5.5 mm/h for the smaller and larger aggregate systems, respectively). Whereas the steady state IR value of the soil at a given ESP was not affected by the initial aggregate size, a significant effect was observed when gypsum was applied. The difference in the steady state IR values between the soil with smaller aggregates and that with the larger aggregates, in the presence of gypsum, was more pronounced in the soil at the higher ESP level. This difference was due to the disintegration of soil aggregates and the formation of new soil surfaces without gypsum.

Key Words: Soil crust, water infiltration, soil sodicity, soil permeability, soil aggregates, gypsum.