Infiltration of Low Sodium Irrigation Water in Relation to Soil Treatments in the San Joaquin Valley, California\(^1\)

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**Abstract\(^3\)**

Gradual reduction in rate of water penetration into different soils under irrigation has been experienced for many years in parts of the San Joaquin Valley of California. The difficulty has been particularly marked in the early potato and cotton regions in the vicinity of Bakersfield.

Earlier experiments\(^4\) with basin irrigation on uncropped plots had suggested that large applications of ammonium sulfate in combination with irrigation water of low calcium content were responsible for a soil of the Hesperia series for reduced rates of water infiltration, and that applications of organic matter or gypsum would increase infiltration rates. No special use is made of crop residues and farm manure is scarce in the region concerned, but it is now very common practice among potato growers to apply gypsum to their soils in an attempt to increase infiltration rates. Information concerning soil and water properties is not, however, always obtained beforehand.

Experiments were begun in 1942 and continued through 1945 to learn more concerning relationships between soil treatment and infiltration rates upon the Hesperia sandy loam. They were conducted on plots of growing cotton and potatoes at the U. S. Cotton Experiment Station, Shafter, Calif.

Possibly the most significant quality of soil and irrigation water in these experiments is the low Na/Ca ratio possessed by each. The initial Na/Ca ratio of the nearly neutral surface soil, by exchangeable equivalents, was approximately 1 : 23; that of the Station supply of irrigation water, by equivalents, was 1 : 3. The water contained 375 ppm of dissolved solids. An outstanding physical feature of the cultivated soil is a “pan” of high density lying 3 or 4 inches below the soil surface. The density of this zone, though unaffected by soil treatment, increased very slightly during the course of the experiment.

Randomized soil treatments included annual applications of cotton-hulls, ammonium sulfate, and ammonium sulfate plus gypsum, respectively, and untreated controls.

Infiltration rates during approximately the first 30 or 40 minutes of furrow irrigation were calculated after plotting measured volumes of water flow, both on and off the treated plots, as a function of time. A nearly constant rate of volume delivery on to each plot was maintained during each run. Each year, infiltration measurements were made both early and late in the season for each plot.

Although differences having a 5% level of significance were obtained between treatments, these differences were not consistent over the 4-year term for the two crops. It is concluded, under the conditions of this experiment in which soil and irrigation water both have a low Na/Ca ratio, and the water is low in dissolved solids that, where a dense pan exists below the soil surface, no consistently significant, rapid change in infiltration rate can be expected from the direct application, to soil, of ammonium sulphate, gypsum, or cotton-hulls. There is some indication that, for all treatments expect gypsum, the Na/Ca ratio of the soil increased during the experiment. This was most marked under the heavy applications of ammonium sulphate. More recent experiments\(^5\) by others made elsewhere in the valley, where soil and water possess much higher Na/Ca ratios, indicate that gypsum may greatly increase infiltration rates, particularly when added to the irrigation water.

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