NOTES

PRECIPITATION AND SOLUTION OF CALCIUM CARBONATE IN IRRIGATION OPERATIONS

The extent to which CaCO₃ precipitates from irrigation water or dissolves from soil during irrigation operations influences salinity control and the accumulation or replacement of exchangeable sodium in soil. Precipitation of CaCO₃ from irrigation water decreases the salt burden of irrigation systems but increases the Na/(Ca + Mg) ratio of the soil solution and the soil exchange complex. The solution of soil CaCO₃ by irrigation water, on the other hand, increases the salt burden and decreases the Na/(Ca + Mg) ratios. Eaton¹ has proposed and defined two calculated values for evaluating the sodium hazard of irrigation waters as follows:

Possible Na percentage = \( \frac{(Na \times 100)}{(Ca + Mg + Na - CO_3^2 - HCO_3^-)} \)

Residual Na₂CO₃ content = \( (CO_3^2 + HCO_3^-) - (Ca + Mg) \)

Calculation of both values involves the assumption that CO₃²⁻ and HCO₃⁻ are quantitatively precipitated in the soil to the limit of Ca and Mg present in the water. Doneen² has extended the ideas of Eaton to the evaluation of the salinity hazard of irrigation waters and proposed the concept of ‘effective salinity’ wherein the actual salinity is adjusted downward for carbonate precipitation by amounts based on Eaton’s assumption.

Adjustment of irrigation water composition to take into account subsequent precipitation of carbonates in the soil is a desirable refinement for calculating leaching requirements and salt balance, and for evaluating the suitability of waters. The available evidence⁴,⁵ indicates that the extent of carbonate precipitation by irrigation waters is highly variable, depending upon the concentration and leaching percentage, and in nonquantitative. Moreover, some waters, carrying carbonates by precipitation, increase in concentration as they move through the soil. The note is to report information gained from studies relative to the extent that carbonates are derived from or dissolved by irrigation waters.

Over a period of years the former Rubidoux Laboratory and subsequently the U. S. Salinity Laboratory with other agencies, has conducted salt balance studies in several irrigated areas of Western United States having predominately calcareous soils. For both irrigated areas (diversions) and outflow (drainage), data are available on volume of salt burden determined as individual ions. In most cases the outflow water includes water that has not passed through soil. This influences the validity of the data for the soil salt burden. Moreover, changes in the quantity of dissolved HCO₃⁻ stored in the soil will influence the outflow/inflow ratio of carbonates as a measure of carbonate precipitation. This influence should be small, however, as only limited amounts of dissolved carbonate are stored in the soil or pass out of the soil in drainage.

¹ Contribution from the U. S. Salinity Laboratory, Soil and Water Conservation Research Division, ARS, USDA, Riverside, California in cooperation with the 17 Western States and Hawaii. Received Dec. 18, 1963. Approved Sept. 23, 1964.


<table>
<thead>
<tr>
<th>Irrigation operation and period</th>
<th>Source</th>
<th>Ca</th>
<th>Mg</th>
<th>Na</th>
<th>CO₃²⁻ + HCO₃⁻</th>
<th>SO₄</th>
<th>Cl⁻ + NO₃⁻</th>
<th>pH_h</th>
<th>Water</th>
<th>Outflow/inflow ratio</th>
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<tr>
<td>Valley Div., Yuma Project, 1-1-45 to 9-30-46</td>
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