Sunland Analytical
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When and Why to Use Gypsum

Typically, gypsum is sold as a soil amendment that will facilitate water penetration into the soil. Under the appropriate soil conditions this is absolutely true. However, these conditions exist only when soil Sodium (chemical symbol Na) is elevated relative to Calcium (chemical symbol Ca). Fortunately, most soils do not have this disproportionate Sodium to Calcium ratio and, therefore, don't need amendment with Gypsum. If the Sodium is high then Gypsum (Calcium Sulfate) is a excellent source to supplement soil Calcium concentrations.

So how does soil acquire excess Sodium? Without the soil leaching effects of good rains and when water high in Sodium (typical of reclaimed water) is used for irrigation, Calcium in the soil may be replaced by Sodium. As a result water penetration into the soil may be limited.

An easy way to understand what is occurring is to visualize Calcium as though it had two arms and could thus bind soil particles together (Fig.1). In

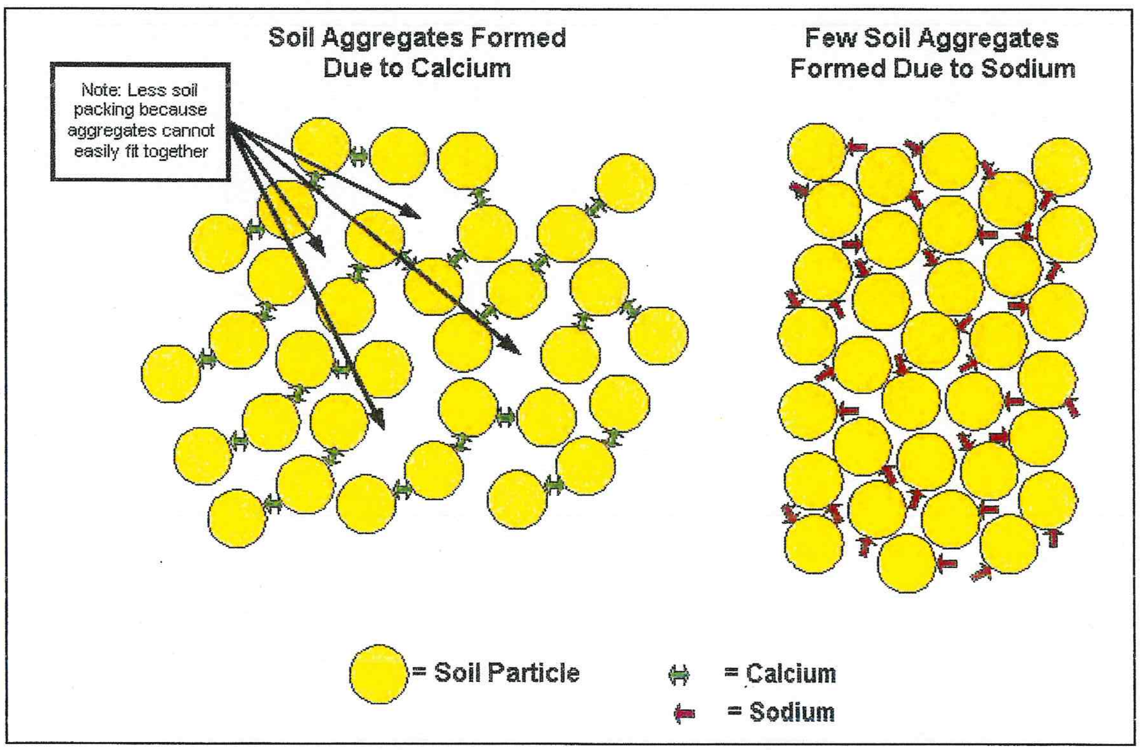

Figure 1. Difference is Soil Particle Packing with High Calcium or Sodium

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contrast, Sodium with only one arm binds to particles, but does not hold them together. As a result, Calcium aggregates soil particles and Sodium will not. These calcium-aggregated particles can be considered more difficult to pack together than then non-aggregated particles bound to Sodium. This means that there may be more space between the Calcium aggregated particles and, thus, easier passage of water. In contrast, the non-aggregated particles bound to sodium compact well minimizing the space between them and limiting water flow (Fig.1).

Both the Sodium and the Calcium on these soil particles are termed "exchangeable" which means that for some time (very short) the Calcium or the Sodium separate from the soil particle and either join back to the same soil particle, bind to another soil particle, or remain in the water around the soil particles. Since both Sodium and Calcium can bind to the same sites on the soil particle, when a Sodium comes off (dissociates) a Calcium can take its place or

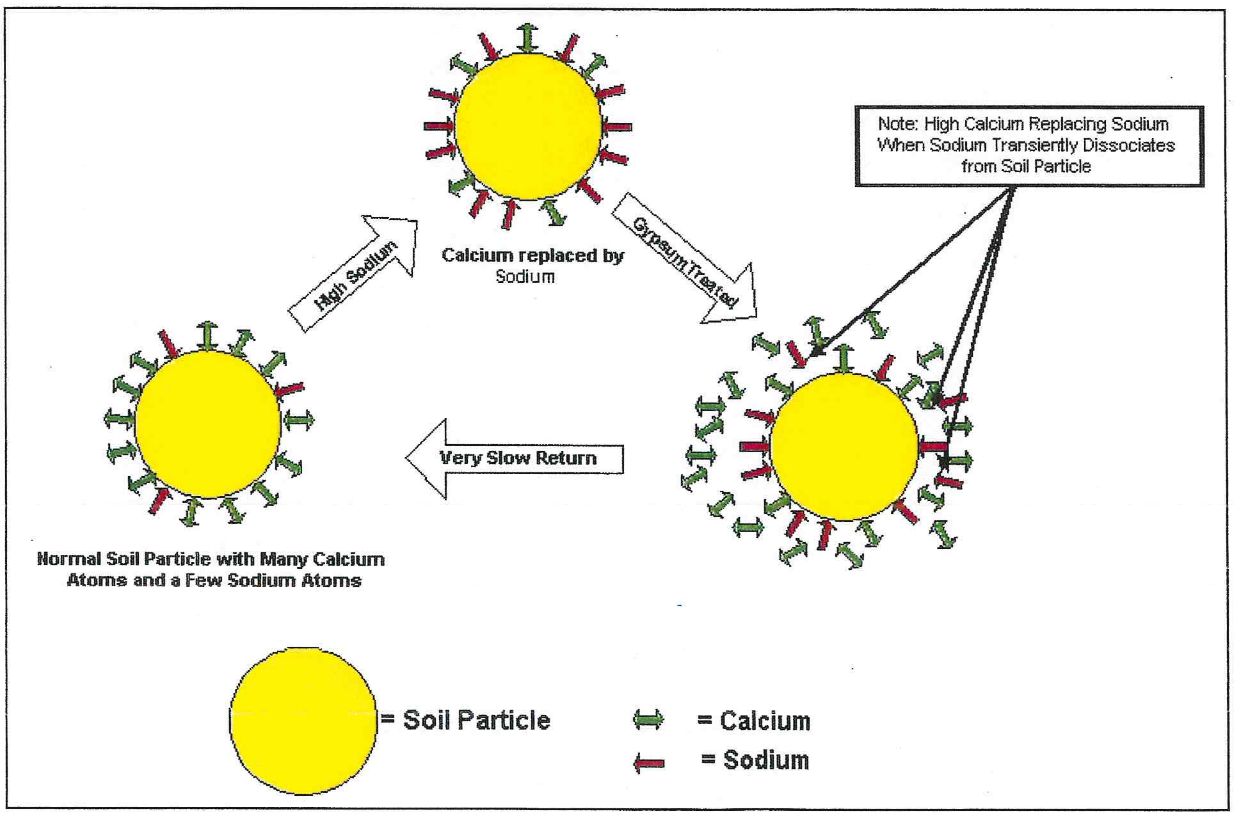

Figure 2. Exchange of Sodium and Calcium on Soil Particles

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visa versa (Fig.2). By increasing the concentration of Calcium in the water surrounding the soil particles, the odds of which atom (Sodium or Calcium) binds back to the soil particle are changed. You can increase soluble Calcium by treating the field with gypsum (Calcium Sulfate). When the field is irrigated, the calcium in the Gypsum creates soluble Calcium and, thus, the atoms of Calcium in the soil water will outnumber the Sodium. When a Sodium momentarily separates from the soil particle and goes into the soil water it will effectively be out numbered by the soluble Calcium. Therefore, the odds are that the Calcium will bind back (Fig.2) to the soil particle and not the Sodium. With time, this method will allow a soil structure with higher amounts of Calcium and thus more aggregated soil particles, which allow better water penetration.

When is the Sodium getting too high? This is best evaluated by the BASE SATURATION values on the soil analysis. The Base Saturation values are percentages for the numbers of atoms of Sodium, Potassium, Calcium and Magnesium. A reasonable rule of thumb is that below a Sodium Base Saturation percentage of 5%, treatment is likely not needed. Between 5 and 10 % some treatment is advisable and over 10% treatment is required to maintain use for agronomic purposes.

The amount of Gypsum to apply is a function of the amount of Sodium it is necessary to displace. This will be a function of the soil texture, sand will require less than clay (where Sodium Base Saturation is the same). Thus, it is best to base the amount on an appropriate Gypsum Requirement analysis. Such analysis is a standard part of Sunland Analytical's Agricultural analyses (STP.3, STP.4 & STP.5) and landscaping analyses (LTP.3, LTP.4).

Two additional points should be considered. First, application of gypsum is useless without adequate drainage to allow the excess Sodium to be leached from the soil by good quality water. Thus, adequate drainage of the soil must exist or be installed. Finally, where soil requires Gypsum application, because the excess Sodium has limited water penetration, renovation of the soil must also include physically disrupting the soil by ploughing or tilling. This allows new soil aggregates to form with new intra soil particle space for water movement and air retention.