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Can Gypsum Improve Water Penetration?

*Bill Peacock**

Can gypsum improve water penetration? The answer is probably yes if you are irrigating with low-salt water (canal water) on loam or fine sandy loam soils. The answer is definitely yes if your soil is impermeable because of excess exchangeable sodium (alkali). The answer is probably no if compaction has slowed water infiltration or your soil is inherently impermeable because of fine texture.

Low Salt Water: Irrigating with water that is very pure (less than 250 ppm soluble salts) can slow infiltration into sandy loam or finer-textured soils. This is commonly a problem on the east side of the valley where growers rely heavily on canal water originating from snow melt.

The application of 1 to 2 tons per acre of gypsum ($CaS0_4 \cdot 2H_20$) in late spring or early summer can increase infiltration as much as threefold. Gypsum is spread on the soil surface or placed in furrow bottoms without incorporation. With low volume irrigation systems, gypsum is spread on about a six foot strip down the drip line.

Gypsum will increase water infiltration for three to five irrigations, then the benefit diminishes as calcium is leached from the surface soil. To maximize surface calcium levels and infiltration rates during summer months, gypsum should be applied in the spring: do not (if possible) apply gypsum in the fall or winter months since some calcium will be leached from the surface soil by rainfall reducing the benefit by summer.

Don't incorporate the gypsum. Incorporating the gypsum reduces calcium levels at the surface reducing the effectiveness of the treatment.

Gypsum may have to be applied every year to improve infiltration when primarily using low-salt water. A possible alternative is to switch to pump water containing higher soluble salts for critical summer irrigation. However, pump water is relatively expensive and may not be available in some areas.

Infiltration can also be increased by applying gypsum directly to the irrigation water at a rate of 500 to 1000 pounds per acre-foot of water. This increases the calcium concentration in the water by 2 to 4 meq./L. Although specially designed equipment is required to apply gypsum to water, less gypsum is needed than a soil application to achieve the desired results.

Applying gypsum to irrigation water has effectively increased water penetration using low-volume irrigation systems (drip, fogger, micro-sprinkler, etc.). In a three-year study conducted in a drip irrigated orchard in Tulare County, adding calcium continuously to the irrigation water tripled infiltration rates over untreated, low-salt water.

Reclamation: Gypsum is also used to reclaim sodium affected soil (alkali). Sodic soils contain excessive amounts of exchangeable sodium in proportion to calcium and magnesium. This results in dispersion of soil particles which reduces soil permeability to water and air.

A commercial laboratory can sample your field and determine the gypsum required to reclaim a sodic soil. For reclamation, gypsum is usually applied in the fall or early winter at three to five tons per acre, although gypsum can be applied at any time of the year and still be effective. Gypsum may have to be applied over several years to correct serious alkali conditions.

For reclamation, incorporate gypsum as deeply and thoroughly as possible. It takes about one acre-foot of water to dissolve one ton of gypsum; therefore, gypsum applied in excess of five tons per acre will probably not be dissolved in a single year.

Other materials such as soil sulfur or sulfuric acid can also be used to reclaim sodic soils. Generally, 1 ton of sulfur will displace the same amount of sodium as three tons of sulfuric acid or five tons of gypsum. Soil sulfur is slower acting than either gypsum or sulfuric acid.

Gypsum is available as crude gypsum mined in open pits ranging from 30 to 70 percent pure or as a nearly 100 percent pure gypsum usually sold in sacks. The form of gypsum should be chosen according to the cost of pure gypsum (100% $CaSO_4 . 2H_20$) delivered and this is calculated in the following examples:

Example 1: Gypsum that is 55% pure costs $9 per ton with an additional $12 for hauling and spreading for a total cost of $21 per ton. The equivalent cost of this gypsum (if it were 100% pure) is $21 divided by 0.55 or $38 per ton.

Example 2: Gypsum that is 92% pure costs $32 a ton plus an additional $12 to haul and spread it for a total of $44 per ton. The equivalent cost for 100% pure gypsum is $44 divided by 0.92 or $48 per ton.

Gypsum requirements provided in laboratory reports are based on 100% pure gypsum. As an example, a laboratory report indicates a gypsum requirement of 4 tons per acre. This would require 4.34 tons of the gypsum that is 92% pure, or 7.27 tons per acre of the gypsum that is 55% pure. It should also be noted that finely ground gypsum is more reactive than a coarse grade.

**Bill Peacock is a University of California Cooperative Extension Farm Advisor in Tulare County*