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Gypsum: The Essential Amendment **Brent Rouppet, Ph.D.**

There cannot be enough said about the benefits, advantages and utility of using high-quality gypsum with soils, crops and irrigation water. Having worked with agriculture from Mexico to Canada, and from China to the Outback of Australia, I am still impressed at how entire crops have not only benefited with gypsum's use, but have been saved from failure. Gypsum is such an essential amendment that its routine and frequent use is actually necessary for the sustainability of all irrigated soils.

There is nothing new about gypsum's use with agriculture considering for centuries this naturally occurring mineral has been mined. In fact, Benjamin Franklin in his celebrated book: *An Agricultural Catechism; Or, The Chemistry of Farming Made Easy* (1831) spoke of the importance of "taking care of the land." Mr. Franklin suggested such practices as planting clover to put nitrogen back in farmed soil, and recommended using plaster of Paris (gypsum) as a fertilizer. However, gypsum is currently being seriously underutilized for use with irrigated agriculture throughout California and the West.

Nature provides two forms of gypsum, anhydrite (CaSO_4) and gypsum dihydrate ($\text{CaSO}_4 \cdot 2\text{H}_2\text{O}$). Chemically, the only difference between anhydrite and dihydrate is two molecules of crystallized water. Both anhydrite and dihydrate immediately begin going into solution when subjected to rain or irrigation water, and at fine particle sizes (-325 mesh) the difference in time that it takes for anhydrite versus dihydrate to go into solution can be measured in milliseconds. Both are excellent forms of calcium sulfate.

Invariably gypsum helps soils and plants for one reason or another since in nature it is unique and incomparably versatile and multi-functional. Gypsum serves without equal as a fertilizer, a soil conditioner and a soil amendment.

Major benefits of the addition of high-quality gypsum materials are:

- # An excellent fertilizer source for calcium and sulfur. There are 16 nutrients required or essential for plants. Calcium and sulfur are 2 of them. With calcium and sulfur deficiencies appearing more and more frequently, gypsum is a practical and economical source of these nutrients.

- # Improves soil structure and compacted soils. Calcium provided to the root zone flocculates (or combines) sand, silt, clay and humus particles together, thus improving water and air movement and plant root growth in the soil medium. Water penetration problems cause ponding and runoff, depriving root systems of needed moisture and oxygen, and wastes irrigation water.
- # Amends and reclaims soils high in destructive sodium and magnesium. Sodium and magnesium (to a lesser extent) act the opposite as calcium in soils by destroying structure and reducing water, air movement and root growth. There should to be sixteen times more calcium in the soil than sodium, and eight times more calcium than magnesium.
- # Replaces harmful salts. Sodium, chlorine and many other salts in higher levels in irrigation water and soil are detrimental to plant growth and development since they rupture and destroy plant cells.
- # Is necessary when irrigation water is “too pure” and when soils are low in total salts. When the electrical conductivity of soils and water is low, surface soil sealing and water penetration problems occur if irrigation water does not contain adequate calcium.
- # Helps with high bicarbonate irrigation water. Bicarbonates form free lime when water evaporates resulting in reduced available calcium and increased soil pH. The reduction of available calcium also leads to loss of soil structure and reduced water infiltration.
- # Enhances water use efficiency. Twenty-five to 100 percent more water is available in gypsum treated soils versus untreated soils; less irrigation water is required to achieve the same results.
- # Reduces runoff, erosion and soil crusting. Erosion begins when rain or irrigation drops strike bare soil detaching soil particles. Aggregates stabilized by gypsum are less prone to crusting and erosion since there is limited runoff due to larger, more stable aggregates.
- # Counteracts acidity in subsurface soils. Gypsum leaches into the subsoil replacing aluminum and other acid forming ions, thus allowing roots to penetrate the hostile subsoil more readily.
- # Along with composts, manures and other plant materials, use of gypsum helps rebuild the supply of soil organic matter, and is a major means for increasing the efficiency of its accumulation.
- # Of all calcium compounds gypsum is considered the most convenient to use, inexpensive in price, and is a natural organic source.

From the standpoint of plant nutrition and as a soil conditioner or soil amendment, gypsum uniquely helps soils be more productive and more fruitful than any other single product on earth. Working with soils and crops worldwide I have witnessed gypsum's use being largely underutilized, yet know that routine and frequent application of this essential amendment is required for the sustainability of all irrigated soils.

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