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Commentary

# Gypsum and Humic Acid: Optimizing Soil Health and Crop Production

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While the current world population is over 7.5 billion, it is projected to be 9.8 billion by the year 2050. Already of the 7.5 billion, 2 billion people suffer from malnutrition and hunger is soaring to levels without modern precedent. Now farmers, agronomists and soil scientists are being called upon to do an additional job of producing the extra food.

Recently we were talking about this issue with Daniel Davidson, Ph.D., Agronomist for a company that mines and markets gypsum (calcium sulfate [$CaSO_4.2H_2O$]) products. Dr. Davidson stated: "In irrigated agriculture worldwide, the number one issue that growers are facing is soil structure related problems. And these problems are escalating. There are specific problems for plant growth and production in saline and sodic soils; especially poor soil structure which limits water and air infiltration, and root penetration into the soil. Reclamation of these soils requires the leaching of exchangeable sodium and other harmful salts from the root zone.

The only way this has been accomplished worldwide is with the application of calcium sulfate products, mainly gypsum. The calcium removes the sodium and magnesium from the cation exchange sites, and now they can be leached down through the soil profile. Other calcium products simply cannot supply enough calcium to get the job done. High levels of sodium and magnesium are especially detrimental to overall soil health".

We were also talking with Richard Taylor who markets humic acid products. Mr. Taylor emphasized: "Applications of organic materials such as humic acids are a critical farming practice that can improve the chemical and physical properties of the soil and increase overall fertility of soils. Also, studies have proven that the application of humic acid in combination with gypsum can improve soil structural stability and promote the leaching of harmful salts. Soils with low organic matter content generally have poorer soil structural stability".

Gypsum helps soils and plants for myriad reasons since in nature it is unique and incomparably versatile and multifunctional. This naturally mined product serves without equal as a fertilizer, a soil conditioner, and a soil amendment. It has been claimed that gypsum's routine and frequent application is actually necessary for the sustainability of all irrigated soils.

**Major benefits of high-quality gypsum:**

- An excellent fertilizer source for calcium and sulfur. With calcium and sulfur deficiencies appearing more and more frequently worldwide, gypsum is a practical and economical source of these essential nutrients.
- Improves soil structure and compacted soils. 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.
- Replaces harmful salts. Sodium, chlorine and many other salts in higher levels in irrigation water and soil are detrimental to plant growth.
- Helps with high bicarbonate irrigation water. Bicarbonates form free lime when water evaporates resulting in reduced available calcium and increased soil pH.
- Enhances water use efficiency. Twenty-five to 100 percent more water is available in gypsum treated soils vs. untreated soils; less irrigation water is required to achieve the same results.
- Reduces runoff, erosion and soil crusting. Aggregates stabilized by gypsum are less prone to crusting and erosion since there is limited runoff due to larger, more stable aggregates.
- Along with humic acid, composts, manures and other plant materials, use of gypsum helps rebuild the supply of soil organic matter.

Humic acid is a natural soil conditioner that acts as an organic chelator (a binding agent) and microbial stimulator. It has a unique carbon matrix which includes a high concentration of trace minerals and organic acids. Humic acids are extremely important as a means for transporting nutrients from the soil into the plant because they can hold onto ionized nutrients (e.g. $Fe^{2+}$, $Cu^{2+}$, $Zn^{2+}$), preventing them from leaching away.

**Major benefits of humic acid are:**

- Increased nutrient uptake in plants. This is one reason they make such excellent soil amendments, and why they can pair with gypsum. Without humic acids, some nutrients in fertilizers become unavailable to plants.
- Chelation of harmful toxins in the soil, preventing them from being taken into plants. This applies to toxic heavy metals and pesticides. The toxic molecules are trapped by humic molecules and are locked up.
- Increased water retention. Water retention is becoming more important as agro-ecosystems become strained. Humic acid is also beneficial in sandy and/or low clay soils.
- Increased microbial populations in the soil. Scientists are increasingly realizing how important a healthy and vigorous microbiome is to the soil environment.
- Better overall soil structure, since poor soil structure is claimed to be one of the greatest problems with irrigated agriculture.

Recent studies worldwide have also shown that applications of gypsum in combination with humic acid displaced more sodium from the root zone and enhanced the cation exchange capacity. This means that more essential plant nutrients can now be available to the plants.

Working with soils and crops worldwide we are perhaps seeing both gypsum and humic acid use being largely underutilized, yet we are learning that perhaps routine and frequent application of these two essential amendments in combination are required for the overall soil health, sustainability and increased production of all irrigated soils.

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