Sunland Analytical
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Sulfur – Plant Metabolite & Soil Amendment

So your plants are turning yellow (or light green), but you recently applied fertilizer having adequate nitrogen. One consideration might be, is whether the light green foliage is in the older leaves or the new leaves. If in the newer leaves, this may suggest a sulfur deficiency. This difference may be ambiguous, but in general the light green color is usually attributed to nitrogen or sulfur deficiency. When dealing with agricultural crops, where large amounts of fertilizer will have to be applied to remedy the problem, plant tissue analysis should be performed to determine which nutrient is actually required.

Sulfur is a plant macronutrient incorporated into several amino acids which are then utilized to make the plant proteins important for plant structure and metabolism. Much of the plant sulfur is taken into the roots from the sulfur in the soil that is in the form of sulfate ($SO4^{-}$). Thus, sulfate in soil is the important consideration when determining what is required for pre-plant preparation.

Sulfur in the soil is predominately (approx. 95%) in the form of organic sulfur which is not readily available for plant utilization. Over time it may become available through microbiological degradation, but should not be considered for immediate plant nutrition. Generally, sulfate-sulfur in a range of 10 to 50 ppm in soil are considerate adequate for most

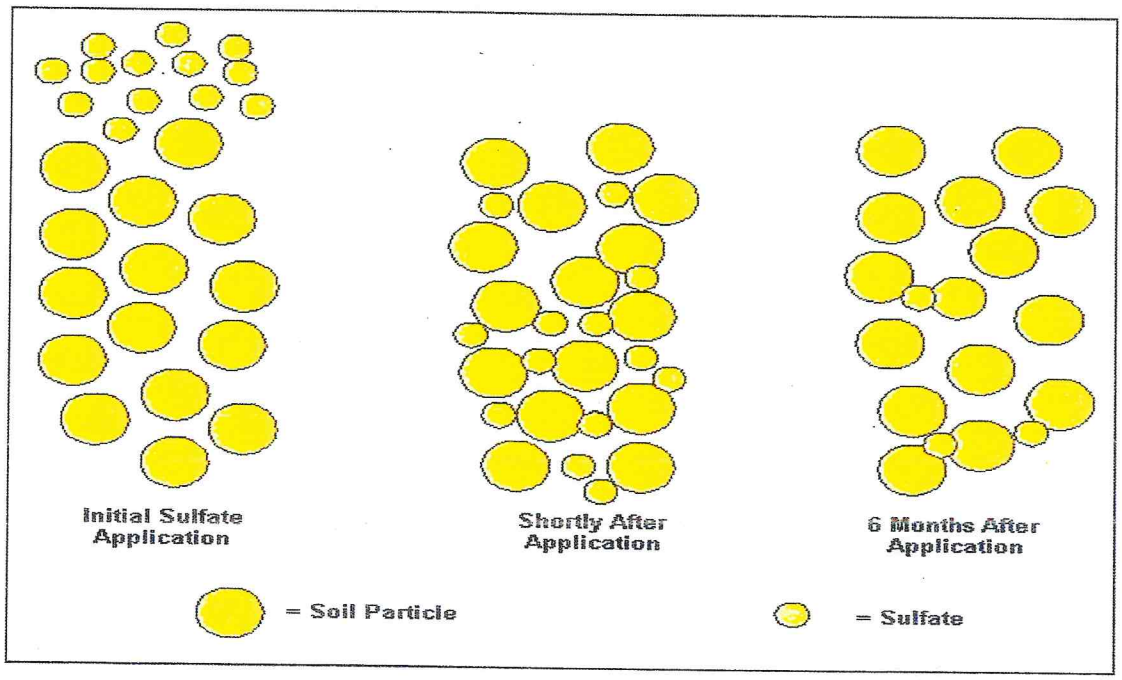

Figure 1. Sulfate Penetration into Soil

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plants. Also, soluble sulfate doesn't accumulate in most western soils because of the constant high concentrations of Calcium. Sulfate in the presence of Calcium produces Gypsum ($CaSO_4*2H_2O$) which is quite insoluble

Sulfate, like nitrate, is readily leached from the soil. Recall that the soil particles are negatively charged, since sulfate is similarly charged there is a repulsion between the sulfate and soil particle. When irrigation water passes through the soil (Figure 1), it washes the sulfate out of the root zone. This means, like nitrate, extra care not to over fertilize should be taken so that the plants utilize the material applied. Also, timing for repeated application is important so the the plants have adequate amounts of sulfate for normal growth. Fertilizers like Potassium sulfate (0-0-50-18) (fertilizer bag code for nitrogen%-phosphorous%-potassium%- sulfur% sometimes sulfur is not included) have a dual use where both Potassium and Sulfur are required. This does have the disadvantage that Potassium is usually applied in much larger amounts than is required for Sulfate. An optimal, inexpensive fertilizer preparation is Ammonium Sulfate (Sulfate of Ammonia) (21-0-0-24) which provides both sulfur and nitrogen. Since both the nitrogen and sulfur can be leached from the soil this fertilizer preparation is optimal for use in regular small applications on lawns and gardens.

Elemental Sulfur (yellow powder or pellets), not sulfate containing compounds, is an effective amendment for soil pH modification. The soil pH is a major factor influencing plant growth and if the pH is high, above a pH of 7.5, efforts should be used to decrease the soil pH. One of the most effective methods is to apply elemental Sulfur in specific amounts determined after soil analysis. Sulfur, in the presence of oxygen (in the soil), moisture and specific bacteria, is converted to sulfuric acid which lowers the soil pH. This is a slow process and under optimal conditions will take several months. Also this process may require several applications of Sulfur with the subsequent time for each application to work. This is not a fast process. Even then, only the surface soil has been modified and the pH of soil below that modified can gradually increase the upper soil pH.