SULFUR-BEARING CHEMICALS

For Reclaiming Arizona Soils

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The reader's attention is drawn to a new bulletin, A-27, entitled "Gypsum and Sulfur-Bearing Amendments for Arizona Soils," recently published by this college. Authors are Dr. Wallace H. Fuller, head of the Department of Agricultural Chemistry and Soils, and Dr. Howard E. Ray, Extension Cotton Specialist, with assistance of Dr. Amburgey. This bulletin may be obtained from your local County Agent's office.

Sulfur-bearing chemical amendments have been used for many years on alkaline soils in reclamation and soil management. Amendments such as gypsum, sulfur, sulfuric acid, sulfur dioxide, calcium poly-sulfide, and iron sulfate all provide soluble calcium to the soil solution.

Gypsum is most often used because it is lowest in price. It occurs as a naturally deposited mineral in two forms in Arizona. Gypsite occurs as a powder or as small grains scattered throughout the soil mass. Gypsum occurs as a crystalline or rock form which is mined for agricultural and industrial purposes.

The presence of excess sodium in soils and irrigation water requires the use of a calcium yielding amendment. Excess sodium in a soil causes sealing or dispersion. This change in soil physical condition is a serious problem because it restricts the intake and movement of water and air into the soil.

Also Requires Leaching

Certain sulfur-bearing soil amendments assist in reclaiming soils containing excess sodium by providing soluble calcium for exchange purposes. However, effective leaching must be achieved following application of amendments for reclamation.

The main purpose in adding sulfur-bearing amendments to the soil is to provide or make available soluble calcium. Both the soil solution and irrigation waters supply an abundance of sulfur for plant growth either as sulfate (SO_4--) or other forms. Calcium, on the other hand, is present mostly as an insoluble compound. The sulfur-bearing amendments either supply the necessary *soluble* calcium to maintain good soil tilth directly, or they indirectly make native soil calcium soluble by chemical action.

Continued use of irrigation water containing an excess of sodium increases the accumulation of this harmful element in the soil. The calcium-supplying amendments may be added to irrigation water in some cases to offset this deleterious effect. If the sodium from poor quality water continues to accumulate and cause a serious soil problem it may be dealt with by adding the amendments directly to the soil.

Must Get Rid of Sodium

Alkali (sodic) soils contain 15 percent or more exchangeable sodium. This excess sodium must be replaced by soluble calcium. The reaction for this process is: gypsum + alkali (sodic) soil ⟶ *calcium soil* + sodium sulfate. Sodium sulfate, a soluble sodium salt, must be leached out of the soil before beneficial results may be achieved. The addition of gypsum to irrigation water will counteract a high per cent sodium, thus providing a higher quality water.

The addition of gypsum or any other chemical salt increases the total soluble salt content in the soil or irrigation water. However, the net effect in the soil may be a reduction in soluble salts because leaching is improved. Leaching to remove salts is essential to the reclamation process.

Know Your Soil

The use of chemical soil amendments is governed by several factors.

First, the physical condition in the soil must show a positive need for the amendment. The glamour of any practice will not insure satisfactory results.

Second, the decision as to what chemical amendment to use is influenced by cost, and again by the situation in the soil. Soils containing an abundance of calcium, as most Arizona soils do, lend themselves to the use of sulfur-bearing amendments. Inadequate amounts of *soluble* calcium in the soil make it necessary to use these amendments.

Third, quality of the amendment must be considered. Quality factors include solubility, fineness, purity, and so forth. Fineness is considered as influencing both rate and extent of reaction. The finer the particle size of gypsum, for example, the greater is its value as a soil amendment.

Fourth, there is the question of how much of the material to use. The soil and water testing laboratory at the University of Arizona will test soils to determine the gypsum requirement, and irrigation waters to evaluate the percent sodium. These analyses assist in determining how much gypsum to use and, in the case of soils, this can be converted to the amount of other sulfur-bearing amendments needed.

Finally, method of application of the materials may influence selection and use. Soil applications appear to be the most effective method. As with fertilizers, applications in irrigation water are no more effective than the effectiveness of the irrigation itself.

Water penetration problems usually occur in spots. These are the very spots that get the least of the amendment when it is applied in the water. Solubility of materials in water also influences selection and use. For example, gypsum has a low solubility, making its application to the soil much more practical.

Use Only if Needed

Gypsum and other sulfur-bearing soil amendments should be used only when soil conditions or water quality indicate a need for them. Used properly when they are needed, these materials can be most beneficial. However, if they are improperly used or used when conditions do not warrant such use, they will be ineffective and the problem will remain.

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