SHEPROS®

Safety, Heath & Environment Product Solutions

Soil treatment: an amendment, conditioner and fertilizer.

TETECH Calcined Gypsum Lime

SHEPROS AGRICULTURE SDN. BHD.

(SHEPROS GROUP OF COMPANIES)

TETECH

Calcined Gypsum Lime for Agricultural Uses

TETECH is a moderately soluble source of the essential plant nutrients of calcium, sulfur, magnesium, phosphates, iron, silica and manganese, and can improve overall plant growth. TETECH amendments can improve the physical and chemical properties of soils, thus reducing erosion losses of soils and nutrient concentrations (especially phosphorus) in surface water runoff. TETECH is also an effective amendment for sodic soil reclamation and can be included as a component in synthetic soils used in nursery, greenhouse and landscape applications. In a nutshell, TETECH is one of those rare materials that perform in all three categories of soil treatment: an amendment, conditioner, and fertilizer.

Below are the advantages of TETECH:

TETECH Provides Additional Primary, Secondary and Tertiary Nutrients

Phosphorus

Phosphorus is important in plant bioenergetics. As a component of ATP, phosphorus is needed for the conversion of light energy to chemical energy (ATP) during photosynthesis. Phosphorus can also be used to modify the activity of various enzymes by phosphorylation, and can be used for cell signaling. Since ATP can be used for the biosynthesis of many plant biomolecules, phosphorus is important for plant growth and flower/seed formation. Phosphorus is limited in most soils because it is released very slowly from insoluble phosphates. Under most environmental conditions it is the limiting element because of its small concentration in soil and high demand by plants and microorganisms. Plants can increase phosphorus uptake by a mutualism with mycorrhiza. A Phosphorus deficiency in plants is characterized by an intense green coloration in leaves. If the plant is experiencing high phosphorus deficiencies the leaves may become denatured and show signs of necrosis. Occasionally the leaves may appear purple from an accumulation of anthocyanin. Because phosphorus is a mobile nutrient, older leaves will show the first signs of deficiency.

Calcium

Calcium regulates transport of other nutrients into the plant and is also involved in the activation of certain plant enzymes. Calcium deficiency results in stunting. This nutrient is involved in photosynthesis and plant structure. Blossom end rot is also a result of inadequate calcium.

Sulfur

Sulfur is a structural component of some amino acids and vitamins, and is essential in the manufacturing of chloroplasts. Sulfur is also found in the Iron Sulfur complexes of the electron transport chains in photosynthesis. It is immobile and deficiency therefore affects younger tissues first. Symptoms of deficiency include yellowing of leaves and stunted growth.

Magnesium

Magnesium is an important part of chlorophyll, a critical plant pigment important in photosynthesis. It is important in the production of ATP through its role as an enzyme cofactor. Magnesium deficiency can result in interveinal chlorosis.

Silicon

In plants, silicon strengthens cell walls, improving plant strength, health, and productivity. Other benefits of silicon to plants include improved drought and frost resistance, decreased lodging potential and boosting the plant's natural pest and disease fighting systems. Silicon has also been shown to improve plant vigor and physiology by improving root mass and density, and increasing above ground plant biomass and crop yields. Although not considered an essential element for plant growth and development (except for specific plant species - sugarcane and members of the horsetail family), silicon is considered a beneficial element in many countries throughout the world due to its many benefits to numerous plant species when under abiotic or biotic stresses. Silicon is currently under consideration by the Association of American Plant Food Control Officials (AAPFCO) for elevation to the status of a "plant beneficial substance".

Silicon is the second most abundant element in earth's crust. Higher plants differ characteristically in their capacity to take up silicon. Depending on their SiO_2 content they can be divided into three major groups:

- Wetland graminae-wetland rice, horsetail (10–15%)
- Dryland graminae-sugar cane, most of the cereal species and few dicotyledons species (1–3%)
- Most of dicotyledons especially legumes (<0.5%)
- The long distance transport of Si in plants is confined to the xylem. Its distribution within the shoot organ is therefore determined by transpiration rate in the organs
- The epidermal cell walls are impregnated with a film layer of silicon and effective barrier against water loss, cuticular transpiration rate in the organs.

Si can stimulate growth and yield by several indirect actions. These include decreasing mutual shading by improving leaf erectness, decreasing susceptibility to lodging, preventing Mn and Fe toxicity.

Iron

Iron is necessary for photosynthesis and is present as an enzyme cofactor in plants. Iron deficiency can result in interveinal chlorosis and necrosis. Iron is not the structural part of chlorophyll but very much essential for its synthesis. Copper deficiency can be responsible for promoting an iron deficiency.

Manganese

Manganese is necessary for photosynthesis, including the building of chloroplasts. Manganese deficiency may result in coloration abnormalities, such as discolored spots on the foliage.

TETECH Improves Compacted Soil

TETECH can help break up compacted soil. Soil compaction can be prevented by not plowing or driving machinery on soil when it is too wet. The compaction in many, but not all soils can be decreased with TETECH, especially when combined with deep tillage to break up the compaction. Combination with organic amendments also helps, especially in preventing return of the compactions.

TETECH Decreases Bulk Density of Soil

TETECH -treated soil has a lower bulk density compared with untreated soil. Organics can even decrease it more when both are used. The softer soil is easier to till, and crops like it better.

TETECH Helps Prepare Soil for No-Till Management

A liberal application of TETECH is a good procedure for starting a piece of land into no-till soil management or pasture. Improved soil aggregation and permeability will persist for years and surface-applied fertilizers will more easily penetrate as a result of the TETECH.

TETECH Prevents Crusting of Soil and Aids Seed Emergence

TETECH can decrease and prevent the crust formation on soil surfaces which result from rain drops or from sprinkler irrigation on unstable soil. Prevention of crust formation means more seed emergence, more rapid seed emergence, and easily a few days sooner to harvest and market. Seed emergence has been increased often by 50 to 100 percent. The prevention of crusting in dispersive soils is a flocculation reaction.

TETECH Decreases Loss of Fertilizer Nitrogen to the Air

Calcium from TETECH can help decrease volatilization loss of ammonium nitrogen from applications of ammonia, ammonium nitrate, UAN, urea, ammonium sulfate, or any of the ammonium phosphates. Calcium can decrease the effective pH by precipitating carbonates and also by forming a complex

calcium salt with ammonium hydroxide which prevents ammonia loss to the atmosphere. Actually calcium improves the uptake of nitrogen by plant roots especially when the plants are young.

TETECH Helps Plants Absorb Plant Nutrients

Calcium, which is supplied in TETECH, is essential to the biochemical mechanisms by which most plant nutrients are absorbed by roots. Without adequate calcium, uptake mechanisms would fail.

TETECH Stops Water Runoff and Erosion

TETECH improves water infiltration rates into soils and also the hydraulic conductivity of the soil. It is protection against excess water runoff from especially large storms that are accompanied with erosion.

TETECH Decreases Dust Erosion

Use of TETECH can decrease wind and water erosion of soil. Severe dust problems can be decreased, especially when combined with use of water-soluble polymers. Less pesticide and nutrient residues will escape from the surface of land to reach lakes and rivers when appropriate amendments are used to stabilize soil. TETECH has several environmental values.

TETECH Improves Soil Structure

TETECH provides calcium which is needed to flocculate clays in soil. It is the process in which many individual small clay particles are bound together to give much fewer but larger particles. Such flocculation is needed to give favorable soil structure for root growth and air and water movement.

TETECH Improves Fruit Quality and Prevents Some Plant Diseases

Calcium is nearly always only marginally sufficient and often deficient in developing fruits. Good fruit quality requires an adequate amount of calcium. Calcium moves very slowly, if at all, from one plant part to another and fruits at the end of the transport system get too little. Calcium must be constantly available to the roots. In very high pH soils, calcium is not available enough; therefore, TETECH helps. TETECH is used for peanuts, which develop below ground to keep them disease free. TETECH helps prevent blossom-end root of watermelon and tomatoes and bitter pit in apples. TETECH is preferred over lime for potatoes grown in acid soils so that scab may be controlled. Root rot of avocado trees caused by Phytophthora can be partially controlled by TETECH.

TETECH Improves Swelling Clays

TETECH can decrease the swelling and cracking associated with high levels of exchangeable sodium on the montmorillonite-type clays. As sodium is replaced by calcium on these clays, they swell less and therefore do not easily clog the pore spaces through which air, water and roots move.

TETECH Makes Slightly Wet Soils Easier To Till

Soils that have been treated with TETECH have a wider range of soil moisture levels where it is safe to till without danger of compaction or deflocculation. This is accompanied with greater ease of tillage and more effective seedbed preparation and weed control. Less energy is needed for the tillage.

TETECH Prevents Water logging of Soil

TETECH improves the ability of soil to drain and not become waterlogged due to a combination of high sodium, swelling clay, and excess water. Improvements of infiltration rate and hydraulic conductivity with use of TETECH add to the ability of soils to have adequate drainage.

TETECH Helps Make Stable Soil Organic Matter

TETECH is a source of calcium which is a major mechanism that binds soil organic matter to clay in soil which gives stability to soil aggregates. The value of organic matter applied to soil is increased when it is applied with TETECH.

TETECH Increases Value of Organics

TETECH adds to the value of organic amendments. Blends of TETECH and organics increase the value of the other as soil amendments, especially for improvement of soil structure. High levels of soil organic matter are always associated with liberal amounts of calcium which is part of TETECH. Calcium decreases burn out of soil organic matter when soils are cultivated by bridging the organic matter to clay.

TETECH Corrects Subsoil Acidity

TETECH can improve some acid soils even beyond what lime can do for them. Surface crusting can be prevented. The effects of toxic soluble aluminum can be decreased, including in the subsoil where lime will not penetrate. It is then possible to have deeper rooting with resulting benefits to the crops. The mechanism is more than replacement of acidic hydrogen ions which can be leached from the soil to give higher pH. Hydrogen ions do not migrate rapidly in soils containing clay. It is suggested that the sulfate from TETECH forms a complex ($AIS0^{4+}$) with aluminum which renders the aluminum non-toxic. Also suggested is that the sulfate ions react with iron hydroxides to release hydroxyl ions which give a lime effect to increase soil pH. TETECH can be widely used on acid soils.

TETECH has abundant of Sulfate

TETECH has abundant of sulfate, which is the most absorbable form of sulfur for plants.

TETECH Helps Reclaim Sodic Soils

TETECH is used in the reclamation of sodic soils. Where the exchangeable sodium percentage (ESP) of sodic soils is too high, it must be decreased for soil improvement and better crop growth. The most economical way is to add TETECH which supplies calcium. The calcium replaces the sodium held on the clay-binding sites. The sodium can then be leached from the soil as sodium sulfate to an appropriate sink. The sulfate is the residue from the TETECH. Without TETECH, the soil would not be leachable. Sometimes an ESP of three is too high, but sometimes up to ten or more can be tolerated.

TETECH Decreased pH of Sodic Soils

TETECH immediately decreases the pH of sodic soils or near sodic soils from values often over 9 but usually over 8 to values of from 7.5 to 7.8. These values are in the range of acceptability for growth of most crop plants. Probably more than one mechanism is involved. Ca^{2+} reacts with bicarbonate to precipitate $CaCO_3$ and release protons which decrease the pH. Also, the level of exchangeable sodium is decreased which lessens the hydrolysis of clay to form hydroxides. These reactions can decrease the incidence of lime and bicarbonate induced iron deficiency.

TETECH Makes Water-Soluble Polymer Soil Conditioners More Effective

TETECH complements or even magnifies the beneficial effects of water-soluble polymers used as amendments to improve soil structure. Like for organic matter, calcium, which comes from TETECH, is the mechanism for binding of the water-soluble polymers to the clay in soils.

TETECH Makes Magnesium Non-Toxic

In soils having unfavorable calcium: magnesium ratios, such as serpentine soils, TETECH can create a more favorable ratio.

TETECH Improves Water-Use Efficiency

TETECH increases water-use efficiency of crops. In areas and times of drought, this is extremely important. Improved water infiltration rates, improved hydraulic conductivity of soil, better water storage in the soil all lead to deeper rooting and better water-use efficiency. From 25 to I00 per cent more water is available in TETECH -treated soils.

TETECH Makes It Possible to use Low Quality Irrigation Water

The effective sodium absorption ratio (SAR) of irrigation water should be less than 6 for some crops and less than 9 for others. When it exceeds these limits, TETECH should be applied to the soil or to the water. Use of reclaimed municipal waste water is important for conservation of natural resources. Reclaimed water can be satisfactorily used if amendments, such as TETECH and water-soluble polymers, are also used. Care must be taken, however, to avoid sodium build up in the lower horizons of soil because of excessive leaching when swelling clays are present.

TETECH Decreases Heavy-Metal Toxicity

Calcium also acts as a regulator of the balance of particularly the micro-nutrients, such as iron, zinc, manganese and copper, in plants. It also regulates non-essential trace elements. Calcium prevents excess uptake of many of them; and once they are in the plant, calcium keeps them from having adverse effects when their levels get high. Calcium in liberal quantities helps to maintain a healthy balance of nutrients and non nutrients within plants.

TETECH Decreases the Toxic Effect of NaCl Salinity

Calcium from TETECH has a physiological role in inhibiting the uptake of Na by plants. For species of plants not tolerant to NA, Ca protects from toxicity of NA but not Cl.

TETECH Keeps Clay Off Tuber and Root Crops

TETECH can help keep clay particles from adhering to roots, bulbs and tubers of crops like potato, carrots, garlic and beets. In combination with water-soluble polymers, it is even more beneficial.

TETECH Helps Earthworms to Flourish

A continuous supply of calcium with organics is essential to earthworms that improve soil aeration, improve soil aggregation and mix the soil. Earthworms can do the plowing for no-till agriculture.

Rates

Rates depend on the circumstances and objectives. Typical rates are 125 to 225 kgs per acre for sulfur supplementation and one to two tons per acre every one to two years for soil amendment.

Soil Test CEC Guide

Our experience from working with various soil types, with various Cation Exchange Capacity (CEC) levels, suggests the following application rates based on CEC:

CEC	Rate
< 10	0.5 T/A
10-15	1.0 T/A
> 15	2.0 T/A

Cation Exchange Capacity is the amount of cations a soil can retain. Higher CEC soils have greater capacity to store plant nutrients. Soil CEC increases with more clay, more organic matter and is also influenced by pH.

TECHNICAL DATA SHEET

Constituent	Concentration (% wt/wt)
Calcium Sulfate Dihydrate	60-85
Magnesium Hydroxide	1-20
Iron Phosphate	1-10
Calcium Carbonate	1-5
Calcium Hydroxide	< 3
Silica	1-3
Manganese Hydroxide	< 1
Iron Oxide/Hydroxide	< 1
Magnesium Sulfate	< 1