GRASSLANDS

The following study was conducted to investigate the potential use of Orykta® in dry climate grasslands.

This study was commissioned for the United Nations Development Program (U.N.D.P) for possible export of product.

Summary of Results:

- Application of Orykta® improves the physical properties of most coarse-textured soils by increasing the total porosity of the soils thereby increasing the water retention capacity. More water is available to the plants over an extended period of time especially grasses since their shallow root development significantly limits their efficient use of soil water. The amount of water lost by percolation is reduced considerably and reduced water percolation automatically results in reduced nutrient losses.
- Addition of Orykta® to sands or loamy sand improves the fertility of these soils by increasing their capacity to retain and supply plant nutrients.
- Owing to the appreciable amount of gypsum in Orykta®, it can be used with great confidence to reclaim medium textured sodic soils.

SAN LUIS OBISPO, CALIFORNIA

SOIL SCIENCE DEPARTMENT

CALIFORNIA POLYTECHNIC STATE UNIVERSITY

Orykta® is a unique naturally occurring material found in the Sierra Nevada mountains. Mineralogical analysis performed at the laboratory of Central Mineral Resources, Geological Survey, United States Department of the Interior in Denver, Colorado, has proven that Orykta® contains the components of montmorillonite, a type of clay, two sulfate minerals, natrojarosite, a hydrated iron sodium sulfate and gypsum, a hydrated calcium sulfate as its major constituents.

Montmorillonitic clay is one ofthe most important clay minerals occurring in soils and sediments. The formation of this conglomerate mineral in soil environments require many thousands of years of weathering of sedimentary rocks under specific environmental conditions. Many soils of temperate climate regions possess varying amounts of this clay which is responsible for a large portion of their cation exchange (CEC), which controls their usually high level of fertility. The absence or minimal occurrence of montmorillonite in most arid and semi-arid soils is action required for the production of montmorrillonite constituencies. This is the major reason that most desert soils have an inherently low fertility.

During the chemical processes ofweathering, ions of the alkali metals (Na+, K+, etc.) or the alkali earths (CA++, Mg++, etc.) and other soluble materials enter the residual waters. The exact composition of the weathering products will depend on the type of rocks under decomposition. Orykta® results from the deposition and recementation of weathered products of many types of rocks. It is not surprising that the resulting material contains a wide range of elements or chemical compounds. The chemical composition of Orykta® was analyzed by the Science Laboratory, Minneapolis, Minnesota.

Potential Benefits

A. Improving Soil Physical Conditions.

Soils composed of more than about 80 percent sand are texturally classified as sands and loamy sands, in the agricultural sciences. These soils have two major problems: inadequate water retention and low fertility. In order to maintain a steady supply of moisture to plants, water application should be frequent because of the quick movement of the water through the profile. The dissolved soluble nutrients move into the groundwater. Fertilizer applications are lost in the drainage waters. This type soils management system is expensive and wasteful. Moreover, plants growing on these soils, especially grasses with shallow rooting depth, wilt after few days without rain during the wet reasons or shortly after the application of irrigated waters. Additionally, the soluble nutrients are leached beyond the root zone.

Application of Orykta® improves the physical properties of most coarse- textured soils by increasing the total porosity ofthe soils thereby increasing the water retention capacity. More water is available to the plants over an extended period oftime especially grasses since their shallow root development significantly limits their efficient use of soil water. The amount of water lost by percolation is reduced considerably and reduced water percolation automatically results in reduced nutrient losses.

B. Solving Soil Fertility Problem

Sands usually have low organic matter content, low cation exchange capacity, and are easily leached. The result is that sands have little natural fertility and can lose what little may exist quite easily by leaching. The addition of Orykta® to sands or loamy sand improves the fertility of these soils by increasing their capacity to retain and supply plant nutrients. Plants, especially grasses, growing on soils amended with Orykta® will obtain the nutrients in the root zone. The plant roots will have a greater development in the soil enabling a better uptake of nutrients. Consequently, the result is better crop. This improvement in quality may be expected in grasses growing under the same conditions.

The application of Orykta® at the rate of 900 lbs per acre to an arid soil in Colorado River Valley, California, has shown a significant increase in the quality of Alfalfa hay growing on this soil. In Equador, South America, Orykta® was applied at the rate of 800 lbs per acre to a pastureland. The better pasture was evidenced by the gain in weight by cattle grazing on the land.

Potential Benefits

C. Other Benefit

Many soils formed under low rainfall have an accumulation of sodium. The problem is that the high sodium percentage causes an unfavorable physical condition that makes leaching an extremely slow process because of the low permeability. These soils can be reclaimed by applying sufficient amounts of gypsum, a hydrated calcium sulfate, to replace the exchangeable sodium, Na+. Owing to the appreciable amount of gypsum in Orykta®, it can be used with great confidence to reclaim medium textured sodic soils.

The pH of these sodic soils is usually about 9 to 10. Grasses and most other plants cannot grow well under these conditions, not only because of the high pH but also the high sodium content. Upon application of Orykta®, the calcium replaces the sodium on the cation exchange site and the resulting sodium sulfate will be leached out from the soil system by irrigation waters. The soil becomes flocculated, the soil structure is improved and the soil pH may be lowered to about 7.0. This result was observed in Maricopa County, Arizona, upon application of Orykta® at the rate of 1000 lbs per acre to a soil of pH 10.4. The pH dropped to 7.1 and a successful crop.