GYPSOIL™
BRAND GYPSUM

FACT SHEET

Correcting Sodic Soils

Gypsum counters sodium toxicity and brings to life soils damaged due to irrigation, oil drilling and extended periods of rainfall

Salinity and sodicity are related conditions but different problems related to soil salt content that can be damaging to agricultural production. This fact sheet specifically addresses the problem of sodicity.

Causes of sodic soils

High sodium water is a serious problem throughout many irrigated cropping areas. As sodic water soaks into the soil, sodium is deposited through the profile. Excessive exchangeable sodium in the soil causes swelling and dispersion of the clays which severely degrades soil structure. This leads to surface crusting as well as a significant reduction in water infiltration. Sodic soils often occur when irrigation water bicarbonate and sodium concentrations are high relative to calcium and magnesium.[1]

Brine spills in Midwest oil producing areas is another common cause of crop-damaging sodicity. Brine used in oil drills ranges in salinity or saltiness from 100 to 400,000 milligrams per liter, or up to about 11 times saltier than seawater.[2] Brine spills are also becoming more common in oil producing states such as North Dakota where industry data indicates the spill rate per well almost tripled between 2004 and 2013. On average, more than two gallons of wastewater are spilled per minute in North Dakota.[3]

Sodium salt damage is also common in other areas such as soils near the ocean where severe weather events deposit seawater on the land and areas where heavy rainfall causes sodium deposits to move to the soil surface.

Key Terms

Salinity is a general term for saltiness, and specifically used by agronomists to refer to soil solution that contains a high level of salt. Common salts include sulfates of sodium, calcium and magnesium but chlorides of the same ions are also seen. Carbonates can also be reason for high saline conditions.

Sodicity is the term agronomists use for saline soils specifically contaminated with too much sodium.

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Soil problems

High sodium levels in soils leads to a number of problems. Soil structure is lost and aggregates are broken down resulting in impaired internal drainage and surface crusting. Reduced seedling emergence and viability are often early signs of sodicity. Water ponding and surface runoff are common even during light rainfall events. Laboratory analysis of suspicious soil is the best tool to diagnose sodicity and formulate a plan for remediation.

Remediate soils with GYPSOIL

When soils are laden with water-soluble salts such as sodium, GYPSOIL brand gypsum is an excellent option to correct soil chemistry imbalances. GYPSOIL is calcium sulfate ($CaSO_4 \bullet 2H_2O$). When applied to sodic soils, gypsum's sulfate sulfur binds with excess sodium (Na+), converts it into a soluble salt (Na_2SO_4) and moves it down and out of the rooting zone. The calcium from GYPSOIL then replaces the excess sodium on the soil cation exchange sites. The calcium allows soil clays to bind together, forming aggregates. Aggregates create pore spaces for water and air to move through the soil profile making a better place for soil biology and crop roots to live.

The amount of gypsum needed for reclamation depends on several factors including soil characteristics and chemistry. Recovering a foot depth of sodic soil on one acre requires approximately 1.7 tons of pure gypsum ($CaSO_4 \bullet 2h_2O$) for each milliequivalent of exchangeable sodium present per 100 grams of soil.[3] GYPSOIL recommends using a laboratory analysis to determine the exact gypsum requirement but in general rates of 3 to 5 tons per acre per year are required to remediate sodic soils.

Restoration of sodic soils is slow because soil structure, once destroyed, is slow to improve. Growing a salt-tolerant crop in the early stages of reclamation and cultivating in crop residues or manure adds organic matter which will help increase water infiltration and permeability to speed up the reclamation process.[3]

After application of gypsum, growers see remediation begin slowly with the return of native plants. As soil particle aggregation improves due to the rebalanced soil chemistry, signs of soil productivity will increase.

For more information about repairing salt-damaged soils, contact your local agronomist or GYPSOIL brand gypsum representative at 866-GYPSOIL (497-7645).

Steps to remediate sodic soils

1. Review soil test and electrical conductivity ratings with a qualified agronomist.
2. Apply GYPSOIL and till the soil. Till the top four inches for most soil but in hardpan conditions, tilling deeper, to about 12-18 inches is recommended.
3. Allow water to solubilize gypsum and flush the salinity. Once the GYPSOIL is applied and mixed into the soil, a sufficient amount of quality water (rainfall or irrigation) must be added to solubilize the gypsum and move the displaced sodium beyond the root zone. As a rule of thumb for estimating the amount of water to apply: 6-12 inches of water dissolves 1 ton of gypsum and 1 inch of water/inch of soil depth reduces salinity by 80-90%. Therefore, 18-60 inches of water will dissolve 3-5 tons of gypsum and flush the salinity deep into the subsoil and out of the rooting zone.
4. Test soils annually to monitor soil chemistry and guide subsequent GYPSOIL applications.
5. Often, during the second year after application, gypsum is used at half rate to continue repairing salt-damaged soils.

[1] Drought Tips, California Department of Water Resources, Water Conservation Office, University of California, 1993 92-33

[2] Produced Water Society, http://www.producedwatersociety.com/#!produced-water-facts/chwh

[3] Oilfield Spill Problems Worsen in North Dakota Inside Energy , NET, Nebraska's PBS and NPR , Feb 3, 2015

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