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Solutions Driven by Nature™
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GFT Salt Detoxification Study

The environmental contamination of the greatest number of acres of farmland in the US is caused not by toxic chemicals or oil spills but by salt. Over 23% of irrigable land in the US is now salt impacted, and the number grows every year. In the California San Joaquin Valley alone, over 2.8 million tons of salt enter the valley each year, and only 350,000 tons leave it. Worldwide, the problem is estimated at over 20% of all irrigable lands being salt impacted.

When soil is damaged by salt contamination, the harm extends immediately to native grasses, trees, shrubs and crops, preventing seed germination and plant growth. Saline conditions also destroy favorable microorganisms vital to productive, balanced soil. Soil contamination is most prevalent in two main areas of environmental concern: agricultural irrigation/fertilization and oil production. In most cases, crop irrigation is pumped from underground aquifers that contain high amounts of soluble salts. When land is irrigated with this water, large amounts of salt accumulate on the surface. If salts are not leached adequately, there will be significant damage to plant roots.

Both chemical and natural animal fertilizers contain high amounts of salt. When farmers use fertilizers to increase production, they magnify the problem. The excessive “doses” of salt from these fertilizers cause salt content in the soil to continually increase. Farmers find they have to use more and more fertilizers to produce less and less crop yields and the salt levels steadily increase. Eventually the crops will be destroyed or production greatly reduced unless something is done to prevent, break down or “buffer” the existing salt buildup.

The salt “breakdown” process works like this:

- Salt is a metal and very reactive. Excessive salt amounts act as a toxin to aerobic soil microorganisms that require oxygen to establish their colonies and metabolize nutrients.
- Salt follows the water path and can be flushed from the soil. However, extensive flushing of salt into the soil with water only temporarily corrects the problem. It has not solved the problems which result from high soil salinity.

The GreenFlash Technologies’ salt buffering product, SaltDetoxII-1061 (SD-1061), consists of four products mixed together, SoilRenew-602, SoilDetox-604, BioSoilBoost-101 and NPrime-660. SD-1061 contains live naturally occurring, micro-organisms, organic acids, organic complexing agents, enzymes, hormones and bio-polymers, which increase the availability of plant nutrients and act to build humus by enhancing soil microbial activity. Nutrients are mostly taken up in the mineral form as nitrates, sulfates, phosphates, etc., but their availability to growing plants is directly related to aerobic biological activity.

SaltDetoxII-1061 also increases the efficiency of applied fertilizers and results in improved crop response. Organically complexed nutrients are less subject to loss from leaching, volatilization, chemical fixation, and clay fixation. The complexing properties of organic carbon found in SD-1061 serves another important function in many agricultural soils. SD-1061 buffers salts by: 1) dissociation (the process by which a chemical combination breaks up into simpler constituents); 2) improvement in the base saturation percentages which is the relationship between concentrations of four key soil elements – magnesium, calcium, potassium and sodium. These elements are not created or destroyed, but they can be unevenly distributed within the soil in plant-available and unavailable (insoluble) forms. In the case of sodium, where lower water-soluble concentrations are desired, SD-1061 shifts the concentrations into insoluble or immobilized compounds in the soil. This essentially removes sodium from the soil solution so it no longer destroys soil structure or causes root toxicity; and 3) organic chelation (the bonding of an organic compound to a single element or compound at several points instead of at one point) and immobilization of the component elements. Dissociated salts are far less damaging to crops and soil and remain dispersed in the soil profile. Multiple applications of SD-1061 during the growing season are most effective in salt management.

Using GFT's bioremediation and soil "balancing" products to recondition soil will enhance microbial growth by producing and converting organic materials into agents that will combine with salts. These agents act as a "buffer" for the plants. This buffering effect allows soil microorganisms to proliferate, protecting them from harmful osmotic pressures. These conditioners inhibit salt uptake by the plant by a chelating effect, making them less susceptible to salt damage.

A significant salt contamination problem also occurs in oil production fields. As with irrigation, oil pumped from injection wells contains an exceptional amount of saline water. When oil transmission lines rupture, the damage has a two-fold effect. Not only will the leak's salt content contaminate the surrounding soil, the leak also contains hydrocarbons that will destroy native flora, fauna and indigenous microorganisms.

While state and federal regulatory agencies enforce the cleanup of hydrocarbon contamination, until recently cleaning up salt problems was not considered economically feasible. Flushing with water didn't provide a permanent solution and there were no additional alternatives. After any such salt contamination, the land usually is written off as being unable to support plants.

Salt damage to soil cannot be ignored. Consumer liability is beginning to play a role. For instance, if a transmission line leaks on land that is used for cattle grazing or farming, the owner likely will demand the cleanup of the land. Using bioremediation for transmission line leaks will alleviate both the salt and the hydrocarbon damage.

The GFT agricultural line includes an assortment of salt "buffering" products which will not only buffer any salt contamination but will return salt-contaminated land to a rich and productive soil which will then support all types of crops. All of this occurs at a reasonable price and in a timely manner.

There are products that buffer salts through soil application (irrigation or spraying on soil) while others are formulated for foliar (leaf) application. They are "leaf friendly". GFT foliar products are organically complexed and salt-buffered to ensure maximum uptake and translocation. This reduces the occurrence of leaf-burn or phytotoxicity.

Plants have differing levels of tolerance to the salinity in the soil. As a general rule, the higher-value fruit and vegetable crops are relatively salt intolerant, while forage and field crops have a somewhat higher tolerance. A few examples are given below.

Crop Salinity Tolerance		
Crop	**Ec(0)**	**Ec(25)**
Barley	8.0	13.0
Wheatgrass	7.5	11.0
Soybean	5.0	6.2
Flax	1.7	3.8
Corn	1.7	3.8
Lettuce	1.3	3.2
Oranges	1.7	3.2
Strawberries	1.0	1.8

In this table salt tolerance is given in terms of electric conductivity, where Ec(0) represents the maximum salinity a crop can handle without suffering yield decreases (in mmhos/cm), and Ec(25) is the point where a 25 % yield decrease occurs and the crop's economics becomes questionable.

In a spring 2006 experiment in North Dakota, barley, with an 8.0 Ec (0), was grown on a field whose salinity had an Ec of 16.9. This is 2 times higher than the maximum salinity of barley before degradation. Photos of the field, before and after two years of production, are given below. As shown in the before photo, the field was covered with salt to the point it looked like snow, and had never grown anything, even weeds. This field was treated with an earlier version of SD-1061, starting about one month before planting and continuing through the early growth period of the crop cycle.

The specific laboratory report for the soil being treated is given in Attachment 2. Note comments of analyst concerning the likelihood of successful crop growth.

BEFORE GFT SALT DETOX TREATMENT
Photo taken March, 2006

AFTER GFT SALT DETOX TREATMENT
Photo taken August, 2008

SOIL AND PLANT LABORATORY, INC.

Orange Office
Lab No. 06-192-0501
July 19, 2006

Greenflash Technologies
1001 W. 17th St. Suite C
Costa Mesa, CA 92627

Attn: Jack Distaso

SALINE ANALYSIS SAMPLE

Attached is the data sheet for the analysis performed with a soil sample delivered to the laboratory on the 7th of July. Data interpretation and comments are provided below.

Analytical Results

The reaction of the soil is slightly alkaline on the pH scale measuring 7.6. Qualitative lime was identified in the preferred 'low' range.

The salinity (ECe) is excessive at 16.8 dS/m. Excessive sodium and sulfate are influencing the salinity values. Sodium is also not properly balanced by calcium and magnesium indicated by the elevated sodium adsorption ratio (SAR). A soil structure hazard is expected due to the excessive chemistry conditions. Boron is elevated and boron toxicity can be expected which is normally identified as marginal leaf burn on older foliage and/or poor plant performance.

Nitrogen and phosphorus levels are high optimum, while potassium is slightly low. All micronutrients are low.

Comments

Reclaiming this soil is not possible due to the excessive chemistry conditions. Even the most tolerant plants specimens would be expected to experience various degrees of poor performance and possible decline. It would be important to identify the actual depths in which these severe chemistry conditions exist for the identification of how much import soil will be required.

Please contact the office if we can be of any further assistance in this matter.

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SOIL FERTILITY AND
MICRONUTRIENT ANALYSIS
AO1 (partial) or A17 (full)

Orange Office
Lab No. 06-192-0501

Samples Taken: Samples Rec'd: 7-10-06

Sample #	Half Sat%/ TEC	pH Qual Lime	ECe	NO_3 N	NH_4 N	PO_4 P	K	Ca	Mg	Cu	Zn	Mn	Fe	B (ppm)	SO_4 (meq/l)	Na (SAR) (meq/l)	Sample Description / Log Number
				Parts Per Million Parts Dry Soil										Sat Ext			
0000	727	7.6	16.8	156	5	110	254	3408	584	2.1	1	16	14	1.20	230.0	198.0	
	296	l		3.0		3.4	0.6	0.7	0.9	0.5	0.1	0.5	0.1	4.0	76.7	(40.5)	06-E186 13 5

7/18/06

Sufficiency factor (1.0=sufficient for average crop) below each nutrient value. N factor based on 200 ppm constant feed.
The value below sodium (Na) result is the SAR = Sodium adsorption ratio. Half Saturation %=approx field moisture capacity.
Sat.ext. method for salinity (ECe as dS/m), Boron (B), Sulfate (SO4), and Sodium (Na). Major elements, Nitrogen(N),Potassium(K), Calcium(Ca) and Magnesium(Mg) by sodium chloride extraction. Phosphorus(P) by sodium bicarbonate extraction. Copper(Cu), Zinc(Zn), Manganese(Mn) & Iron(Fe) by DTPA extraction. TEC(listed below Half Sat.) = Est.Total Exchangeable Cations (meq/kg).