AQUATROLS

Tech Tips

Caltrisal®

Improving and Maintaining Soil Structure

Good soil structure is critical to healthy turf growth. Soil structure is created when a group of primary soil particles are held together by various soil-stabilizing agents to form larger aggregates. The orientation of these aggregates in the rootzone defines the small and large pore spaces that are essential for good infiltration and drainage, as well as the proper balance of water and air.

There are many conditions that can affect the stability of soil aggregates. Splashing rain or irrigation water, traffic, cultivation and the presence of sodium can all work to weaken or destroy soil aggregates (The Turfgrass Environment, Turgeon, 1985). When this happens, infiltration rates are reduced, aeration in the soil is reduced, and salts can accumulate in the rootzone. This sequence of events can negatively impact the rootzone environment and, ultimately, the quality of the turf.

Soil aggregates are held together by polyvalent cations such as Ca++ and Mg++, as well as various forms of polysaccharides and organic matter (Turgeon, 1985). The key to maintaining good soil structure is to maintain good aggregate stability. One way to achieve this is to enhance the availability of calcium in the rootzone soil solution. Increasing soluble calcium can offset the detrimental effects of rain and irrigation droplets, traffic and sodium.

The traditional way to enhance calcium in the soil solution is to add more of it to the surface where it can slowly solubilize, displace Na ions and improve aggregation. Depending on the pH environment of the soil, this can be accomplished through applications of gypsum or limestone.

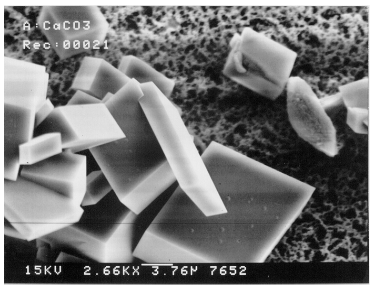

Figure 1

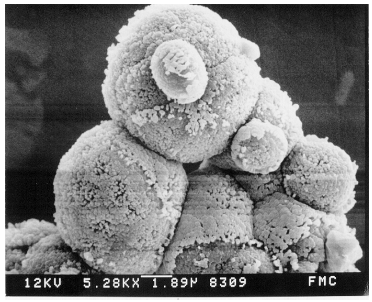

Figure 2

While this has been an accepted practice, both gypsum and limestone are slow to act. It would be beneficial to have tools that enhance the availability of applied calcium to ensure that more calcium is available to maintain aggregate stability.

Caltrisal is a patented formulation of polymaleic acid that will do just that. It enhances the solubility of calcium present in the rootzone by interrupting the crystallization of calcium carbonate. Calcium carbonate typically forms hard, smooth crystals in the soil (*figure 1*). By interrupting this process, more calcium stays in solution, and the calcium carbonate that does crystallize is amorphous (*figure 2*). These mis-shaped crystals are much more readily re-solubilized.

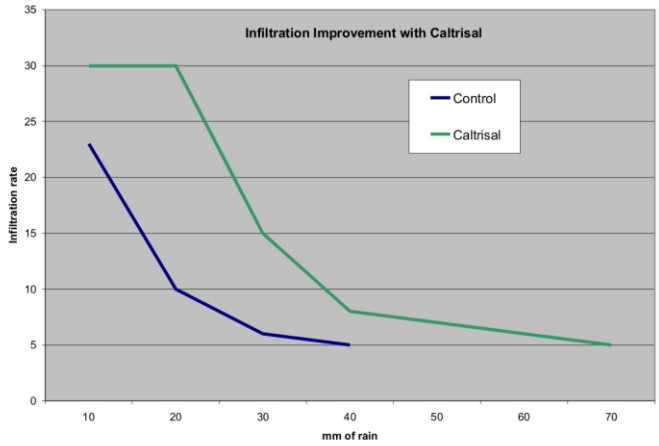

Figure 3

By enhancing solubility, more calcium is active in the soil solution to bind small clay particles together and re-aggregate the soil. The increase in available calcium will also displace sodium, a common cause of aggregate destruction, from the soil particle; again allowing the soil to re-aggregate.

Studies conducted at the Volcani Institute in Israel (Keren, Ben-Hur et. al.1995) looked at soil aggregate strength under different precipitation simulations in a calcareous (calcium-containing) soil (*figure 3*). They noted that the soil aggregates were more stable when treated with Caltrisal, and therefore infiltration rates decreased much more slowly than in the untreated soil. This work also showed that evaporation from the soil surface dropped sharply in the Caltrisal treated soil which is probably due to more water being able to infiltrate deeper into the rootzone.

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Effect of Caltrisal on Physical and Chemical Characteristics of Field Soils (Silty Loam)

Dose	EC (dS/m)	SAR	pH	Total Carbonates	Mean Particle Diameter (mm)	Dispersed Clay (%)	Apparent Density (gm/cm3)	Actual Density g/cm3	Total Porosity (%)
0 gal/ac	4.84 a	2.02 a	8.15	8.9	.34 a	5.4 a	1.37	2.72	49.57 a
3.2 gal/ac	2.68 b	1.32 b	8	8.24	0.44 b	3.72 b	1.31	2.72	52.02 b

Figure 4

University tests done both in soil columns and in the field show improved soil physical and chemical conditions in Caltrisal treated soils. A total of 3.2 gallons of Caltrisal were applied in multiple applications during the course of the season. The table above shows significant increases in mean particle size and total porosity while significantly reducing dispersed clay. Caltrisal enhanced re-aggregation of the soil fines. With these improvements in physical characteristics, there is a better balance of water and air in the rootzone. In this same independent university research, soil chemistry improved as well (*figure 4)*. Sodium adsorption ratio (SAR) and electrical conductivity (EC) readings were significantly lower in the Caltrisal treated soils. Not only has Caltrisal created a better physical environment, it has also improved the chemical environment of the rootzone so that roots are not damaged by salts and sodium.

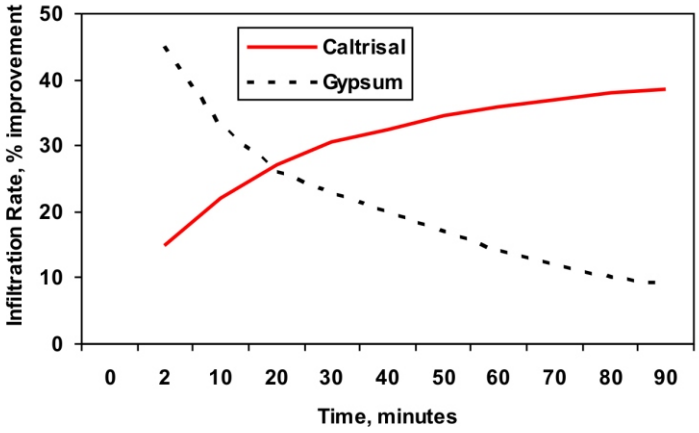

Figure 5

In research conducted in clay soils at the University of California Desert Research and Extension Center, the effect of Caltrisal compared to gypsum alone on infiltration was measured (*figure 5*). While gypsum initially increased infiltration into this soil by 45% over the control, the improvement is short lived. Caltrisal improved infiltration over the control for a longer period of time, and more consistently than gypsum alone. Caltrisal in conjunction with gypsum, where additional calcium is needed, is an excellent rootzone management program.

Effect of Caltrisal on Leaching Sodium from a Silty Clay Loam Soil in California

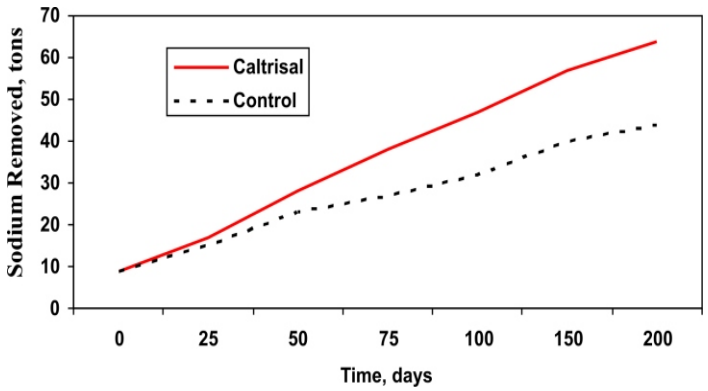

Figure 6

At a rate of 1.3 quarts per acre, Caltrisal has been shown to help move sodium and salts out of the rootzone (*figure 6*). This enhances leaching practices where superintendents and turf managers are trying to leach sodium and salts out of the soil. In this study, Caltrisal was applied to a silty clay loam. Over the 160 day trial, Caltrisal removed much more sodium from the soil than just traditional leaching by itself.

Once soils are re-aggregated, infiltration and drainage are improved and a better balance of water and air is established in the rootzone. Salts and sodium are leached below the rootzone, so the environment for root growth is enhanced.

Because the conditions that negatively impact soil aggregation are continual, management strategies are necessary to address this situation on an ongoing basis. Whether you have poor soil structure, are using effluent water, or have naturally occurring levels of salts in your irrigation water, Caltrisal used in a regular program in conjunction with calcium applications will help you improve soil aggregation. Better soil aggregation means better water, salt and nutrient movement through the soil. Better soil aggregation also means that more of the surface area of the soil particles is available to adsorb nutrients. Increased aggregation leads to more pore space for water infiltration and gas exchange. All improve turf productivity and nutrient efficiency.