GYPSUM USE ON TURFGRASSES

University of Maryland
Turfgrass Technical Update
TT - 83 March 2003

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Much interest has been generated regarding the application of gypsum to turfgrass areas as a cure for a variety of soil problems. Some individuals appear to regard gypsum as they would a wonder drug, and swear by the miraculous ability of gypsum to correct compaction, poor drainage, and other turf management problems.

Unfortunately, claims about the benefits of gypsum in most of these cases are related to uncontrolled situations where a variety of factors, such as fertilization and aerification, were also modified to correct the existing problems. Thus, it is nearly impossible to determine whether improvement of the turf was due to the gypsum or to other management practices.

Excess salts killed germinating turf seedlings

Also, and again unfortunately, very little research has been conducted to examine the merits of gypsum applications to turfgrass areas. However, by understanding the properties of gypsum, one can at least make some judgments about what benefits might or might not be expected from gypsum applications.

Gypsum is a combination of the calcium cation (Ca^{+2}) and the sulfate anion (SO_4^{-2}). Each molecule of $CaSO_4$ is associated with two water molecules; the proper chemical formula for gypsum is $CaSO_4$-$2H_2O$. This brings us to the most immediate potential benefit of gypsum, which is the calcium and sulfur nutrition of the turfgrass plant. When one ton of gypsum per acre is applied about 465 pounds of calcium and 372 pounds of sulfur are applied.

Calcitic or dolomitic limestone can also be used to supply calcium to the plant. However, gypsum and limestone differ in two ways: gypsum is more soluble, and it has little effect on soil pH. Thus, where the soil pH is in a desirable range but calcium levels may be too low in relation to magnesium or potassium, the application of gypsum may be beneficial. It should be kept in mind, however, that this situation rarely occurs in Maryland.

Although a certain balance of calcium and magnesium is important in pasture grasses because of its effect on animal nutrition, no turf field research has shown a negative effect of calcium-magnesium imbalance in typical soils (imbalances have been observed in golf greens and very sandy soils). Thus, where both the soil pH and calcium are low, limestone applications should be made, and where soil pH is adequate, no nutritional benefit should be expected from additional calcium applications from gypsum.

Of greater interest, and perhaps greater benefit, is the sulfate contribution of gypsum. Although research information is scant, it indicates that sulfate deficiencies of turf have become more common, especially on sandy soils. This trend is possibly due to improved air quality and use of triple superphosphate instead of normal superphosphate which formerly contained considerable sulfur. Some turfgrass studies have shown beneficial responses to sulfur applications, and it seems that some of responses attributed to gypsum may actually be related to sulfur nutrition.

KEY POINTS

Gypsum contains the plant nutrients sulfate and calcium, both of which may be deficient in sandy soils.

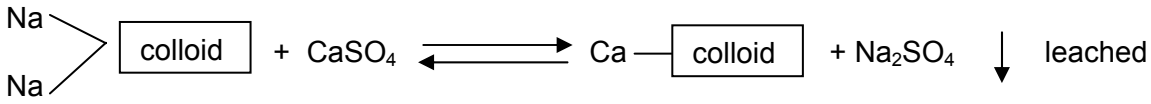
Gypsum can be an important tool in treating sodium (salt) damaged soils.

Gypsum does not affect soil pH. If soil pH is too acidic, use limestone rather than gypsum.

Gypsum should not be expected to substantially improve drainage on most Maryland soils.

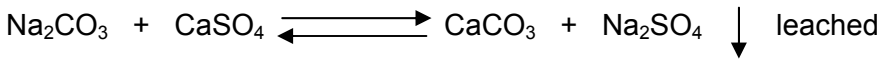
Another demonstrated benefit of gypsum is in the treatment of salt damaged and sodic soils by helping to increase the amount of sodium leached from the soil. The mechanisms are twofold:

1. Calcium from the gypsum can displace sodium (Na) from soil colloids, with the sodium then being leached



AND ...

2. Part of the caustic sodium carbonates (Na_2CO_3) can be converted to sulfates, which can be leached from the soil.



Damage from salt-contaminated soil transported to an athletic field

Thus, soil previously unsuitable for turf growth because of high salt levels can be improved and used after gypsum applications and sufficient leaching. Typically, about 1 ¼ tons of gypsum per acre are applied to a loam in Maryland to treat for salt damage. Less gypsum is needed on sandier soils, whereas more is needed on heavier soils.

Perhaps the most controversial reputed benefit of gypsum applications is the relief of compaction and improvement of drainage. Advertisements often state that gypsum will turn heavy clays into an open, porous structure with improved drainage and better air and water movement. These types of results should only be expected where soil sodium levels are abnormally high. Sodium will cause dispersion of the soil colloids, resulting in a lower percentage of large pores, and thus poorer drainage. Calcium, on the other hand, encourages flocculation of soil colloids, which increases the number of large pores. Addition of gypsum to soils with higher sodium levels, therefore, should 1) displace some sodium from the soil colloids, which can then be removed through leaching, and 2) improve drainage by encouraging flocculation of the soil colloids. However, most soils in Maryland where turfgrass is grown do not have substantial sodium, and the predominant cations found in Maryland soils (hydrogen, calcium, potassium, magnesium, aluminum, iron) do not cause dispersion of the soil colloids.

Thus, major improvements in soil structure and drainage should not be expected from gypsum applications. If sulfur or calcium levels are low enough to cause a turfgrass nutritional deficiency, then improvement of turfgrass growth and the root system could result in some improvement in the soil structure of the top four to six inches of soil. However, this would be a slow process.

More research is needed regarding the use of gypsum in turfgrass areas. Gypsum certainly has a place in treatment of salt damaged land and as a source of the nutrients calcium and sulfur. Quick cures of compaction and drainage problems of Maryland soils, however, are not likely to occur with gypsum applications.

Ultimately, the turfgrass manager may be better off by pinpointing why problems exist and taking proven corrective measures such as improved management, timely aerification, proper grading, and/or installation of drainage systems. Complex soil problems are rarely corrected with simple solutions.