Using inorganic soil amendments

By George Toma

In my travels and working with soils over the past 60 years I have seen a number of soil amendment products. In the early days Lusoil was the only soil amendment product available. Later Danny Litwhiler, former player for the Cincinnati Reds, introduced another soil amendment. Danny's product was made from calcined clay. My how the times have changed.

Inorganic soil amendments have been gaining in popularity over the past few years. These products are used in golf course greens, tee boxes, and fairways, sports field rootzone mixes, and topdressing applications. Interest in inorganic rootzone amendments has been amplified due to the potential potable water supply shortages, the increased use of reclaimed water as well as concerns regarding runoff. Until recently, peat was about the only amendment allowed by the USGA for use in greens. These inorganic products may be better suited to rootzone construction or manipulation because they are less prone to biological degradation and may maintain the original rootzone physical properties longer than organics.

Three types of popular inorganic soil amendments that I am familiar with include calcined clays, zeolite, and diatomaceous earth.

Calcined clays: Marketed as porous ceramics, these are products that have been heat treated or calcined at a very high temperature. The heating increases the structural integrity. Once calcined, they are often screened to a uniform particle size to be used in various rootzones. They do possess a high inherent water-holding capacity that is the result of small internal pores. This stored water may be available to plants. They also have some nutrient holding capacity.

Above: placing an inorganic soil amendment at a NFL practice facility.

INFORMATION PERTAINING TO THE AVERAGE PARTICLE SIZE IN YOUR ROOTZONE MIX MUST BE KNOWN BEFORE ADDING SOIL AMENDMENTS TO AN EXISTING SOIL PROFILE.

Zeolites: Long used in removing environmental pollutants, these have a strong affinity for cations or high CEC, which is good for holding on to nutrients. Be careful in the selection as some zeolites have rather high residual sodium contents that may be harmful to turfgrass.

Diatomaceous Earth (DE): These products are made up of the deposits of diatom shells that have a high degree of internal pore space. DE will retain a significant amount of water. I am very familiar with volcanic/diatomaceous deposits that not only absorb a considerable amount of water but also make the majority of this stored moisture available to the plant.

There have been numerous studies conducted at universities across the country and these studies should be reviewed before considering what type of amendment should be used. Particle size, water retention and release, and nutrient holding capacity should be taken into consideration when selecting the desired inorganic soil amendment. Also helpful is consultation with an accredited soil-testing laboratory.

George Toma, right, has seen it all when it comes to sports turf amendment products.

THE MAJORITY OF PROBLEMS WITH TURF ARE ROOTZONE PROBLEMS THAT CAN BE SOLVED BY DEVELOPING OPTIMUM SOIL CONDITIONS. INORGANIC SOIL AMENDMENTS ARE ANOTHER TOOL THAT CAN BE USED TO PRODUCE POSITIVE RESULTS.

Particle size considerations

Too many coarse or fine particles are undesirable. Particle size significantly affects the amount of porosity and water retention within a rootzone. Fine particles contain less macropores or air filled pores than coarse sands but tend to retain more water than coarse sands. Coarse particles tend to drain more quickly but will exhibit more air filled porosity. Information pertaining to the average particle size in your rootzone mix must be known before adding soil amendments to an existing soil profile.

Water retention

The growth of most plants is closely related to the amount of available moisture. Many inorganic soil amendments are known for their ability to absorb a considerable amount of moisture. The question is: "How much of this stored water is plant available?" If the amendment added to the rootzone releases its stored moisture too quickly, this may lead to droughty conditions or localized dry spots. If the amendment does not release this stored moisture and retain too much water, this will result in poor draining rootzones and cause excessive soil wetness.

Cation exchange capacity

Many inorganic soil amendments have a strong affinity for cations. High cation exchange capacities may allow for a reduction in the use of fertilizers but may also have high residual salt contents. With the increased use of reclaimed water (which may contain elevated sodium levels) on the rise, use of these amendments may prove harmful to turfgrasses.

Desirable criteria for the ideal turfgrass rootzone consists of the following:

1) Drainage
2) Resistance to compaction
3) Moisture retention/release
4) Oxygen retention
5) Nutrient retention
6) Microbial population
7) Temperature stability
8) Proper porosity balance

Nearly all of the desirable rootzone characteristics are directly tied to the proper balance of porosity.

It's hard to improve on Mother Nature. Mother Nature's perfect rootzone is made up of 50% solids and the remaining 50% consisting of capillary or water-holding capacity and non-capillary or aeration porosity. Capillary porosity is made up of small pores that hold water against the force of gravity. Depending upon the type of amendment, much of this retained moisture is available for plant use. Non-capillary is made up of larger pores that, when drained, provide for a source of oxygen required for root growth. The number one deficiency in most rootzones is the lack of air. Balancing and manipulating porosity in the soil can be achieved by the application of inorganic amendments.

Application

Incorporation of soil amendments during the construction phase of the soil profile is usually the best way to go. Rootzone characteristics including hydraulic conductivity, water-holding capacity, bulk density, particle size, and porosity can be pre-determined before construction. Inorganic amendments can also be applied during aerification and topdressing or pre-blended with your choice of sands. In addition application via hydraulic injection such as the hydraulic injection equipment of drill and fill may also be used. Several post-aerification applications are required to produce the desired results in terms of water-efficiency and improved growth characteristics.

Many times problems like brown spots or fungus are treated with water or fungicide and the turf manager is really treating symptoms and not causes. The majority of problems with turf are rootzone problems that can be solved by developing optimum soil conditions. Inorganic soil amendments are another tool that can be used to produce positive results.

Much like sports teams and individual players, some products meet the needs of their marketplace and thrive, while others fall short and ultimately disappear. My advice is to thoroughly research the needs of your individual circumstances. Don't be shy; experiment with a number of product options. Evaluate the results of each one. Then make an informed decision. I certainly have my favorites. Here's hoping you find yours and that it meets your needs . . . AND THEN SOME!

George Toma, one of the founders of the Sports Turf Managers Association, is the most famous turf manager in the country, and has worked on the turf for every Super Bowl.

This article was sponsored by Western Pozzolan. ■