

OVER THE MANY YEARS of consulting with clients, earthworks realizes how important soil tests are for turf manager, but we also realized this data is a road map and not a report card. With a good soil report, you can always work through the hard-to-explain and find the road that your map wants you on.



Last year, EarthWorks consulted on more than 12,000 soil tests from all across the country, something we have been doing for many years now. When one sees this much soil data, trends appear. We see how things change and how they impact the success of the people we have so much respect for. Over the many years of consulting with clients, we have realized just how important this process is, but we also realized that this data is a road map and not a report card. With a good soil report, you can always work through the hard-to-explain and find the road that your map wants you on. Perhaps one of the hardest lessons that we've learned over the years is just how reactive sand based and sand modified soils, or low CEC soils, really are and this has lead us to rethinking how we go about our soil testing protocols.

Having good soil testing data shows us the direction your fertility program would benefit

from if taken. Think of it as the data that your doctor reviews after doing blood work. It's quantitative information that shows us the chemical make-up of the soil. It also gives us an idea as to the physical or even biological nature of that environment. Since 2002, we've partnered with Logan Labs as a trusted source to generate all soil data. These tests follow a true base saturation model for the standard soil tests, but we also combine that information with the data from both the water soluble paste extracts and water tests.

Good soil management combines a working partnership between chemistry, physics and biology. Chemistry addresses the nutrient balance, physics dictates how air and water move through the root zone and when both work well together the soil provides a nice home for the proliferation of beneficial biology. Chemistry affects physics, which affects soil biology, and it is this biology that is so important in mobilizing

nutrients, digesting carbon into forms that microbes can use as energy, promoting good water management and creating checks and balances for pathogens. This is the heart of what Biological Soil Management is all about.

To clarify, CEC is the cation exchange capacity of a soil and tells us how big the soil is. The higher the number, the bigger the soil, and generally, the more clay that soil has which will allow the soil to hold significantly more nutrients. On a high CEC soils, we can modify the soil chemistry to affect the physical profile of that soil, not by changing clay into sand, but by simply flocculating the soil particles and through chemistry, move the soil colloids apart just enough to let more air and water move through the soil profile. The process is known as the Base Saturation Model and this concept of affecting physics with chemistry is not without its critics. You will hear many academics say that this can't work, but I can tell you assuredly, as can hundreds of our clients, that it does work on higher CEC soils, and in fact, I have been seeing just that for close to thirty years. I am happy to share that data with anyone who asks!

Regarding low CEC soils, sand constructed or sand modified soils, especially ones below a CEC of 6, very little nutrient can be held in the soil profile making fertility management difficult. The good news here is that these soils can change very quickly, but the bad news is that these soils can change very quickly! What we have learned by looking at low CEC soil tests over the years, and by talking with the turf managers who manage those sites, is that Base Saturation is not the best tool for managing these types of soils. Instead of studying the data of what is on the soil colloid, via the standard soil test, experience has shown us that by managing the soluble data, as seen on the *water soluble paste extract test*, we have been able to build programs that work effectively and provide the long term success that superintendents are looking for.

The water soluble paste extract test is a soil test, and the lab uses the same soil that it would use for the standard colloidal soil test. The difference is that instead of using a strong acid, Mehlich 3, to literally rip all the nutrients off the soil colloid, it uses de-ionized water as the extracting solution which is much

more gentle on the soil and pulls off, theoretically, just the nutrients that would solubilize in the presence of water like rain or your irrigation water. On these low CEC soils, since there is not much nutrient being held on the soil colloid, we are looking for nutrients that are actually mobile. We can then evaluate that data and build a soluble based program using both granular soluble products (like gypsum or K-mag) and a good carbon based liquid product line (feeding both the plant and soil microbes) to help the plant get what it needs when we know that the soil cannot provide it.

One of the most important observations that the paste extract can provide is an understanding of how high the level of sodium and bicarbonates are in that soil profile. Both of these typically come from the irrigation water and can easily accumulate in the root zone causing plant stress. Because of these potential excesses, we suggest that turf managers run water tests a few times per season. I would contend that the concerns of excess sodium and bicarbonates may be the *first limiting factor* in any turf manager's fertility program, and that everything else may fall in line behind these limitations when trying to reduce plant stress.

Bicarbonates seal the soil surface preventing air and water from moving into the root zone easily. Soil biology needs air and water to survive, and when either is limited, microbes are affected and can die off in isolated areas. Microbiology produces byproducts known as globulin, which helps to keep the soil colloid moist and friable. When bicarbonates seal off oxygen and water movement to those areas, the soil dries out and becomes hydrophobic. This leads to localized dry spot (LDS) conditions and can be very difficult to manage. The water soluble paste extract is the best tool to evaluate just how much bicarbonate there is in the soil profile and help us build programs to stay ahead of this concern.

The paste extract can also show us, very effectively, just how soluble sodium is in the root zone. Often we see sodium at moderate levels on the standard colloidal soil test, but when we run a paste extract, we can actually see that sodium is highly soluble. This can lead to sodium induced wilt stress; a phenomenon that occurs in soils when sodium is high and can

be identified on the soil tests when the percentage of sodium becomes higher than the percentage of potassium. In this situation, the sodium can rush into the plant cell and dehydrate it. You may see wilt and assume that it is environmental and that the soil needs water, but too often it is a chemical wilt and water may not help at all since it is often the source of the sodium. Again, the paste extract is our best tool to monitor this issue and stay ahead of it especially as we move into the heat of the summer, use more irrigation water and need our turf to be at its best.

After years of seeing sodium and bicarbonates accumulate in the soil, as seen on the paste extract tests, and then hearing from the superintendents that they're fighting LDS and wilt stress problems on those sites, we knew we needed to build a solution. Almost 10 years ago, EarthWorks developed the Kick Rinse In program designed to remove the sodium and bicarbonates from the soil's root zone. Details can be found on our website at www.soilfirst.com. It starts with calcium in the forms of gypsum and Cal Vantage, which knocks the sodium and/or bicarbonates off the soil colloid. That is followed by Kick, a humic acid product, which grabs (or chelates) the recently removed excesses and keeps both from re-attaching to the soil colloid. Then a penetrant surfactant pushes all of this out of the soil root zone. Immediately after the Kick Rinse In, and before irrigation, potassium sulfate is applied, because if not, the sodium and bicarbonates in the water will replace what was just removed, but potassium can fill those liberated colloidal sites with something more beneficial. This is one of the main reasons potassium is so important in a good turf program.

Sodium and bicarbonates are not unique to sand based low CEC soils; they can easily be an issue on high CEC soils as well, but sodium and bicarbonates are much more aggressive on sand because there are fewer buffers in those soils like silt, clay or organic matter. These observations led EarthWorks to build another very important program that has shown great success in making changes with our client's soils: our *Monitoring Testing Protocol*. In this program, we select a couple of

sites to monitor with the paste extract and we run those tests once a month. As an example, on sand constructed golf course greens we run paste extracts on the same two greens every month. Because these low CEC soils can change so quickly, this program allows us to stay ahead of the curve, monitor sodium and/or bicarbonate build up; see when nutrients like phosphorous or calcium are falling short or catch if over applications have been made which can throw off the balance of other nutrients. This monitoring program is especially valuable as we move into the hot stressful summer months.

On low CEC soils, which are very common in sports turf, the water soluble paste extract test is our primary data stream. This provides us the information we need to see what nutrients may or may not be available to the turf and helps us build a soluble program to reduce plant stress. It also helps us stay ahead of the curve when it comes to sodium induced wilt stress or localized dry spots caused by high bicarbonates. These sand base soils do not have much in the way of buffers like organic matter that can help sequester some of the built up salts. We know that a good carbon based fertility program can provide these needed buffers. Through years of soil testing and thousands of reports, many run on the same sites for over 20 years, EarthWorks has built premium products like the Replenish line of dry fertilizers, a complete Soil First Foliar line of liquid fertility tools and soil amendments like Renovate Plus, to help you manage even in the toughest conditions. Most importantly, we have learned that we are always learning! By studying quality soil data, we can help turf managers, for whom we have so much respect, make both their job and their life a little richer.

Please feel free to give us a call with any questions, or call one of our many sales support partners at your local turf supply distributor.

Check out EarthWorks Website - www.earthworksturf.com -- for more information.