CORE ISSUES
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Soil Chemistry and Structure

The general principles have served us reasonably well

As we approach a period where both soil amendments and renovations are being planned it is timely to reflect on some of the basic frameworks we have worked within for some time now and refresh ourselves on the 'why' question. Annual soil testing allows us to monitor for both significant and subtle changes in our soil chemistry. It is the monitoring, data archiving and review over time that allows us to amend our soils steadily, ensuring the changes we initiate are based in evidence and as much as possible occur at speeds and in ways nature cooperates with. We know our soils are a dynamic environment – they change in response to many forces – both biotic and abiotic. We also know changes rarely happen quickly; rather they tend to occur quite progressively (almost incrementally) over time. For these reasons we stay aware, and amend regularly, so we can gently steer our soil chemistry in helpful directions. This type of approach reduces the likelihood of needing amendments on masse that are costly and at times difficult to coordinate, rather it allows practioners to gently tune soil chemistry each year looking to work around benchmarks shown historically to be where healthy turf is supported.

Whilst there are differing views on how to test, interpret, modify and support good soil chemistry there is a consensus in the turf management fraternity that the root systems we so heavily depend on need a healthy soil environment. That healthy soil environment involves many elements from microbiology to biochemistry and a range of items in between. The fact there are many differing views on specifics of this subject area is acknowledged, however we do have some useful history that suggests the basic principles we have worked with to date have served us fairly well. So, if we at least start at that point, and try to stick to some basic philosophies that demonstrably have stood the test of time we can be reasonably sure we will continue to work towards some good outcomes.

The two category system

Broadly speaking soil testing has fallen into a couple of categories for analytic purposes. Low CEC soils and moderate to high CEC soils. The low CEC soils are generally sands of poor nutrient holding potential and for these we are more focused on simply ensuring enough nutrition is available to turf root systems to support the basic needs the living plant has. In higher CEC soils (higher clay or organic matter content) we have a luxury of knowing their inherent characteristics mean minimum requirements are probably being adequately met in most circumstances and we can now go one step further to attempt to arrange some of the desirable chemical components in relative quantities thought to deliver a more optimal soil structure.

LOW CEC soils

The introduction of the USGA spec sand dominated golf green was quite revolutionary if measured against the golf green construction prior. Literature of the time (and after) talks about greens being previously built using a 1-1-1 mix of sand - topsoil – peat with clay bases being used for water retention purposes. It also suggests traffic was not really an issue needing to be managed and equally mentions the overall effectiveness of the 1-1-1 approach

being rather hit and miss. The USGA specifications put some metrics to parts of the green construction exercise and we have since put many more metrics around them. The concept of CEC already existed but took on more relevance when the resultant CEC of the new construction methods was much lower (around 5-6). Nowadays this is the nominal point around which a switch in assessment method between sufficiency and base saturation may occur. CEC's under 5 are clearly the SLAN domain.

BEFORE - 30/05/2016

FIG 1. Black layer present, golf green in Melbourne.

AFTER - 17/08/2016

FIG 2. After Soil Prima, applications on same green.

Stating the obvious sand based greens drain well (and this can be quantified)– but don't hold nutrition well (which can also be quantified). Like our sportsfield cousins when we build on sand profiles compromises are made. For giving up some nutrient retention and water holding abilities we generally get efficient removal of excess water from the surface, good flow in and through the rootzone, generously oxygenated soils and the potential to produce a firm putting surface to generate optimal ball roll.

As money and human resources make themselves available, it is not uncommon for a golf course to go through a rebuild in which push up greens produced from native soils are replaced by USGA (or similar) spec greens. And as one would predict, the battle to retain and optimize soil available nutrition extends to these new sites. It's a challenge that is readily accepted though as for many the compromise actually yields a net win – otherwise why would you do it. Accepting this win management practices are modified to suit the situation now in place and an important area of focus becomes the new dynamic in soil chemistry. We understand there are limitations on the ability of critical cations to be placed and held in those rootzones, and intuitively we know to change what we do and how we do it.

Logically we would seek to correct this limitation holding potential through the addition of materials that significantly change the profile characteristics but this is not often adopted (at least not in any great quantity or speed) as this runs counter to the initial objective and tends to introduce other management problems. Therefore, in regards to nutrition and soil chemistry, we monitor and supplement to mitigate the inevitable losses and very carefully (and slowly) add organically based materials to not introduce black layer or restrictions to penetration or percolation of water.

Analytic reference points for assessing this type of soil defer to a sufficiency level type interpretation which basically seeks to ensure the minimum requirements for health are consistently met as a more luxurious approach simply isn't physically (or chemically) achievable. A floor is set based on the turf species and if analytic results sit below the floor recommendations are made for additional nutrition.

Moderate to high CEC soils

Conversely, sites developed some time ago on native soils where there is a generous silt and / or clay content tend not to be highly deficient in basic nutrition. The inherent characteristics of these soils allow more of the critical cations to be retained, and anything additional that is applied tends to be well accepted ensuring more than adequate nutrition is perpetually available. It is acknowledged these soils are those for which annual renovation works focus more on enhancing infiltration of water and the movement of this water through the profile – the reverse of the prior situation, but that doesn't mean the chemistry piece is ignored. Rather, it is optimized.

In these situations where a satisfactory level of critical cations (e.g. Calcium, Magnesium, Potassium) can reliably be considered pre-existing the thinking is to try and optimize soil structure by manipulating the relative concentrations of these to fit a pre-determined model. For the primary cations this has been suggested to be a proportional arrangement of 68-72% Ca, 13-16% Mg and 3-5% K. After taking in to consideration things like soil pH, electrical conductivity, presence / absence / concentration of things like chloride and bicarbonates in irrigation waters, and their concentrations in relation to the primary cations an approach is usually proposed to apply further quantities of targeted components to alter the relative balance in the soil environment towards this model. This should never be done in the absence of a review of irrigation water sources used on the site – but this is a further issue addressed below.

Why do we spend so much time on this?

The pursuit of such optimization is actually the pursuit of a soil structure, oxygen potential, biochemistry and a root development environment that can deliver high quality turf surfaces. It's one of those critical, multi-faceted, indirect relationships that can be difficult to explain to those who have no grounding in turf management or soil science. Greenkeepers just grow grass – right! But we know the green stuff on top is governed by what's below and we know just how complex this interaction can be and how much better turf grows in a helpful soil matrix.

So, without getting too techy, back to the point of sticking with some philosophies that have served us pretty well. History has shown aiming for these sorts of ideal soil conditions does confer benefits to the plant grown within and the 'crop' that ultimately can be produced. This principle applies in agricultural cropping just as much as it applies to turf management. There have certainly been differences of opinion on where critical levels should be set, precisely what interpretation method to use, and for that matter which extraction method best supports the interpretations we are trying to make. But the consensus is that working towards these general benchmarks and having data against which we can assess visible (tangible) and commercial outcomes does place us better than we otherwise would be. A very important caveat that must sit over these general principles, and as noted earlier, the soil environment is not a static environment. It is a dynamic system that can and does change over time. One of the inputs known to lead to change that can be highly detrimental to turf is the use of irrigation sources that contain a vast array of salts and / or suspended solids. These salts alter the 'healthy' chemical balance in soils and do lead to structural, chemical and growing problems. We therefore monitor the changes occurring and try to mitigate the deleterious effects through the application of counter measures. Those benchmarks discussed above (fully agreed or not) do help set reference points to continue to work back towards and give common targets to calculate the quantities of those counter measures we need to get our amendments approximately right. Blunt tool – maybe. Necessary – arguably I suggest yes as well.

How Nuturf can help you

Nuturf has a full analytic service that can sample, analyse, report and recommend how to cater for the different CEC soils we encounter.

An extensive suite of soil amendment products are within the Nuturf range to cater for nearly any need a soil may have. Amendments can be liquid, granular or injectible to irrigation water.

We can walk you through the analytic findings, explain to you the rationale behind recommendations, and help you track changes occurring in your soil over time.

Nuturf has the technical expertise and vast resources around the country to ensure you deal with a single professional service provider from beginning to end.

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