

Advice Sheet 19: Soil and Plant Tissue Analysis for Sports and Amenity Turf

Why do analysis?

The quality of presentation and the resistance to wear of sports and amenity turf is highly dependent upon plant health. Unless the plant is given sufficient water and nutrients in a strong rootzone then quality will suffer.

Soil analysis provides ground managers and green keepers with valuable information on the nutrient status of turfgrass rootzones and when combined with analysis of the turfgrass itself provides an excellent management tool.

Amenity/sports turf fertilisers and seed are high value specialist products and to achieve maximum efficiency from their use an integrated programme of soil and tissue testing is important because decisions can be made based upon known facts.

Without knowing soil/plant nutrient status there is a risk of under or over fertilising which increases financial and environmental risk. This is especially true of sand construction rootzones and perched water table systems where high percolation rates and low nutrient retention create a high fertiliser demand.

Soil physical properties and analysis

At NRM we can provide testing of rootzone materials for physical properties such as particle size distribution (including grading curves) and bulk density. Other properties such as hydraulic conductivity (percolation rate) and porosity we do not offer in house testing for, but please contact us for advice on preferred sub-contractors.

Particle size distribution (including USGA spec)

Important for assessing rootzone materials and the hydraulic compatibility of topdressings. High sand content rootzones are increasingly popular but have high hydraulic conductivity and low CEC – such rootzones will require irrigation and frequent fertiliser applications.

Saturated hydraulic conductivity (KSat)

This is the rate at which water will move through the soil/rootzone material – high values (> m/day) will drain well but will be droughty in dry conditions. Low hydraulic conductivity will indicate potential drainage problems.

Porosity

This is how much air there is in the rootzone – porosity is a measure of the volume of pores – these are the spaces occupied by air and water in the soil. Without water in the pores, the plant roots will not be able to extract water from the soil. Too much water, and not enough air, will result in water logging and anaerobic conditions.

Density

This is a measure of how well packed a soil/rootzone is and is dependent on how much sand there is in the rootzone. Dense rootzones provide firm, strong conditions but higher densities can indicate compaction and will discourage root growth. Low densities could indicate potentially weak soils.

Clay soils 1.0 (low) to 1.4 g/cm³ (high)

Sand rootzones 1.4 (low) to 1.7 g/cm³ (high)

Soil chemical properties and analysis

Soil nutrient supply is essential for turfgrass. By measuring the concentration of nutrients available to the grass plant, NRM can determine whether nutrient status is low (risk of deficiency), medium/high (sufficiency), or very high (potential toxicity, rare).

In addition to measuring nutrient levels, NRM can analyse rootzones for pH (critical for nutrient availability), Cation Exchange Capacity – CEC (the ability of a rootzone to store nutrients) and Organic Matter (important for monitoring thatch build up, but also in providing and storing nutrients).

pH

The pH of a soil/rootzone is critical for plant health and nutrition. Low pH (typically < 5.5) indicates acidic conditions, which can reduce disease risk but also provide direct toxicity to the grass and can limit the availability of certain nutrients. Higher pH (>6) can also limit nutrient availability and has been linked with increased incidence of Take All in turfgrass.

Sand construction rootzone pH values are variable throughout the year, depending on moisture status, temperature and fertilisers/irrigation water. On a golf course, Fairway pH tends to be low, due to the use of acidifying fertilisers (such as iron sulphate) and natural rainwater. Green pH tends to reflect the pH of the irrigation water and can be higher, typically ~ 6 – 6.5. On a chalky soil, pHs will be 7.5 – 8.5, irrespective of fertiliser addition because they contain so much natural 'lime'.

CEC

Cation exchange capacity is reported in units of milli-equivalents per 100 grams (meq/100g) and is an indication of the ability of a soil/rootzone to retain nutrients. CEC values for sand construction greens are typically 1-5 meq/100g, low values indicating the need for frequent fertiliser additions. Natural soil, such as fairway and winter games pitches, where there is more clay and organic matter, have CEC's of around 15 – 35 meq/100g, whereby there is much greater nutrient retention.

Strategies to change CEC are often fraught with complications. The traditional ways are to add organic matter or clay to the rootzone but this will compromise drainage and surface strength – approach CEC amendment with caution – it is often cheaper and more effective to apply more fertiliser. If you are testing to monitor change in CEC, do not consider anything less than 5 meq/100g difference as anything significant and expect it to go down as well as up!

Organic Matter

Organic matter is a double edged sword. Whilst it provides valuable water and nutrient retention in a rootzone, it is also associated with poor drainage and thatch build up. For these reasons, it is often desirable to maintain a low OM in fine turf surfaces but a greater amount of OM can be of benefit in low maintenance turf.

Major nutrients (NPK)

Whilst Nitrogen (N) provides lush, green grass, desirable for some lawns etc., this is not always desirable as it tends to encourage top growth (at the expense of root growth) – requiring more mowing and lush plants are also more susceptible to bruising and wear. A balanced approach to N fertiliser is required.

Phosphorus (P) is required during establishment but is often omitted from anything but starter fertilisers as it has been associated with increased incidence of Annual Meadowgrass (*Poa annua*) – although trials data to prove this is very limited. Phosphorus provides a very important role in turfgrass nutrition and should not be neglected but proceed with caution if you consider *Poa annua* to be an associated risk.

Potassium (K) is very soluble and easily leached and is one of the most common nutrient deficiencies in turfgrass. K is essential for tough, wear resistant plants and deficiencies can reduce colour quality. Do not be surprised to see K deficiencies!

Trace elements (Fe, S, Ca, Mg, Cu, Zn, Mn, B etc.)

Minor or trace elements are often associated with quality issues in turfgrass. A quick dose of Iron Sulphate gives both iron and sulphur to the plant – resulting in a deeper green colour. Trace elements are also important in both resistance to, and recovery from, wear.

There are a number of trace-element products available on the market and you should be able to find a suitable product – if in doubt speak to your fertiliser provider.

Plant tissue (clippings) analysis

Analysing the soil for nutrients is all very well but it is of limited value without plant tissue analysis. This is because you can have a good nutrient supply in the soil but the plant might not be taking it up and will therefore be showing resistance. This might be because of interference from pH or physical restriction of root growth.

Plant tissue analysis provides a snap shot of plant nutrient status and is a valuable tool in either a preventative fertiliser programme or in diagnosing problems.

Together plant tissue analysis and soil nutrient analysis will tell you whether a deficiency problem is in the take up or the supply of a particular nutrient.

How to take good samples

Soils/rootzones

When taking soil/rootzone samples it is important to sample from the whole rooting depth of the grass (this can be inspected by digging or core/hole extraction). It is also important to sample the whole area, whether it is a lawn, a green, a fairway or an outfield – you should cover sample from all over. Try not to mix areas that are managed differently however (e.g. greens & fairways or pitches & outfields).

You must provide enough sample to fill the box/bag provided – although rootzone is a relatively costly material it is a waste of time and money sending in very small samples because there will not be enough to perform all the analyses required! Remember, if you are hollow coring and sending in the cores as samples, you are probably not sampling deep enough unless you are coring to at least rooting depth.

Plant tissue

One of the simplest ways to collect tissue is from clippings, although these can miss deficiencies that occur in the crown of the plant. Again, fill the bag and get a sample from the whole area in question. Get your samples in the post quickly so that they do not decompose.

When to sample

There is little point in sampling over the winter when turfgrass plants are generally dormant. You should tie your sampling in with your fertiliser programme but remember that you should not be taking samples too soon after having applied fertiliser. We would recommend 1-2 months at least if possible – ideally you should sample before you apply any fertiliser.

Interpreting results – what to expect

When you receive your analytical report it will show you whether your soil/plant has low, medium or high nutrient status. Note that the report will not make a fertiliser recommendation. This is because as an independent laboratory, NRM cannot recommend particular products and there are no nationally available references for fertiliser recommendations in sports turf (there are government sponsored agricultural guidelines for grass but these are for animal nutrition purposes and are too high in N for turfgrass).

Generally, nutrients should be applied in low nutrient status conditions although it is important that any fertiliser programme is accompanied by a good aeration/ decompaction programme and disease control, or the effects of the fertiliser will be limited. Consult your local amenity fertiliser provider for information on appropriate products and application rates, with your analysis results they should be able to make a good recommendation.