GRASS CLIPPINGS 25

Every Green keeper's (GKP) objective is to create and maintain a true playing surface covered by a mat of healthy grass on which the members can enjoy a decent game of bowls.

He knows, however, that in doing so the damage resulting from the passage of the machines used in creating this surface and the traffic of the players would put the grass under a considerable amount of stress while it attempts to repair the damage before the next period of play – the grass must be growing faster than it is being broken down .

It is now up to the GKP to create an environment which will get the maximum response from the grass plant.

A human being cannot survive for long without a regular supply of substances called "Vitamins". These vitamins perform and control important functions in the human body and any deficiency can result in serious illness or death.

The grass plant, also, needs vitamins in the form of certain nutrients or elements.

Each of these "elements " performs a specific function and deficiencies or complete absence will hamper or stop the normal growth pattern of the grass plant.

Most of these elements are found naturally in the soil but, where maximum growth is needed, the GKP might have to augment the supply and ensure that the elements available to the grass plant are in the correct proportion to one another. We call it – fertilising.

The GKP asks himself two questions What is already in the soil ? and, What do I have to do to create an environment which would be conducive to maximum growth.

The only way to answer the first question is to take soil samples and send them to a reliable Laboratory for analysis.

Soil Sample Report

While the GKP is not expected to be able to interpret a soil report like a soil scientist he should know enough to draw his own conclusions regarding conditions in the green's underworld. Here are some of the tests the GKP should be able to interpret correctly

Total Dissolved Solids (TDS), Resistance in Ohms, or Electrical Conductivity (EC)

Salinity in the soil is not uncommon in the RSA especially in those instances where the club relies on underground water. A high concentration of salts would be indicated by a TDS of more than 1000 - this would also increase the rate at which an electrical current passes through the soil which will be indicated by a low resistance eg. Below 350 ohms or by a high EC eg- 6-8 ds/m

The Sodium percentage in the soil will also indicate a high salinity – anything approaching 4 % will be a sign of sodic conditions.

Salinity in the soil can interfere with normal grass growth and while some grasses eg, Paspalum will tolerate saline conditions very well most grasses will have difficulty absorbing nutrients when the soil is saturated with other salts. Reverse osmosis might, even, occur.

The GKP should remember that soil salinity is always higher than the irrigation water because the roots will absorb pure water from the root zone before they absorb salts – thus increasing the concentration of salts in the soil.

Regular treatment with gypsum might be necessary.

Soil Acidity pH

The Lab must indicate which tests were used – H_2O or KCL

For the same sample the KCL reading is slightly lower than the H_2O reading. Neutral in the H_2O test is 7.0.

Sports Turf grass performs best between 6.0 and 6.5 (or 5.5 and 6.0 in the KCL test).

Readings between 5.0 and 7.5 KCL can be rectified by adjustments of the fertiliser programme to bring it to the 5.5 – 6.0 range. Variations above or below the above extremes would need Elemental Sulphur or Lime and expert advice on how to apply them. Extreme variations above 7.5 or below 5.0 must be addressed as the elements have their own optimal pH ranges in which they can be absorbed by the roots eg Magnesium will only become available for absorption at 6.3 whereas phosphorous will stop being absorbed at 8.0.

Cation Exchange Capacity (C.E.C.)

The C.E.C. of the soil is a most important test because it will indicate to the GKP the capacity of the soil to absorb and retain the elements (or fertilisers), he has applied, in the root zone so that they can be absorbed by the grass plant - a very low C.E.C. might require the GKP to fertilise more often.

We often talk about "opposites seeking opposites" – In physics we find that an electro-static attraction exists between negative and positively – charged entities. In the soil a negatively-charged anion will attract a positively-charged cation.

These negatively-charged anions can be found attached to "sites" on the surface of the particles which make up the soil. Cations already present in the soil will become attached to them.

Once attached these cations cannot be removed by leaching water but they can be replaced or exchanged by other cations

When fertilising the positively-charged cations of the fertilisers will enter the root zone and attach themselves to the anions by replacing the cations already there. As the roots absorb the cations of these fertilisers they will be replaced by more cations from the fertilisers (if available in the root zone)

The ability to exchange these cations for the other cations is called the Cation Exchange Capacity of the soil.

The elements most commonly involved in the estimate of the C.E.C. are the cations of Calcium(Ca),Potassium(K), Magnesium (Mg), and Sodium (Na)

The Lab will establish how many cations of Ca , K, Mg, and Na. there are in a given sample of soil and report it as millequivalents per 100 grams of soil (Note More recently many Labs are now expressing the C.E.C. in cmol(+)/Kg – numerically the same as me/100 gms of soil

The number of cations available from each element is directly related to the molecular weight of the element. To calculate the mEq of a sample of soil the GKP divides the molecular weight of the element by it's valency. Eg –

Element	Mol. Weight	Valency	mEq
Ca	40	2	20
Mg	24	2	12
K	39	1	39
Na	23	1	23
Ammonium	18	1	18

The soil sample analysis will show how much of each element is present in the soil in mgms per Kgm.

By dividing the amount of the nutrient (in mgm. / Kg.) by the mEq.of that nutrient the GKP will be able to establish the number of cations of each element in a Kgm of the sample

As the C.E.C. is calculated in mEq / 100 gms of the sample the total must be divided by 10.

If calculated in cmol(+)/Kg then the numerical result is the same but being in Kg the GKP does not have to divide by 10

Sample 1 Lab report

Element,	Quantity ,	Eq /100 gm ,	cmol(+)kg
Ca	874 mgm / 20	= 43.7	= 4.37
Mg	89 mgm /12	= 7.42	= 0.742
K	157 mgm / 39	= 4.03 =	0.040
Na	25 mgm / 23	= 1.1	= 0.11
		Total	5.57

The C.E.C. of the sample is = 5.57

By dividing the cmol(+)kg of each element by the total C.E.C. the GKP will know the relative percentage of each element as compared with the other elements eg

Percentage of each in sample

Calcium	4.37/ 5,57	= 78.4 %
Magnesium	0.7 / 5.57	= 12.6 %
Potassium	0.4 / 5.57	= 7.18 %
Sodium	0,1 / 5,57	= 1.79 %

This information is very important when the GKP draws up a fertilizer programme – the following norms must be observed to produce high quality turf eg The percentage of Magnesium must be not less than one fifth and not more than one half of the Calcium

The following table would be the recommended range -

Cation	% of C.E.C.
Calcium	65 – 75 %
Magnesium	12 - 20 %
Potassium	5 – 15 %
Sodium	below 5
Aluminium	0 %

Sample 1 indicates a high level of Calcium. Relatively low Magnesium and Potassium. Sodium is well within acceptable limits.. The C.E.C. is rather low – indicating sandy soils with low Organic Carbons.

Imbalances in the Calcium/Magnesium ratio and/or in the Potassium /Magnesium/.Calcium ratios might create an induced deficiency in the other two nutrients.

If either Sodium or Aluminium is above the indicated range then it can cause toxicity in the grass plant.

If Magnesium is less than 20 % of the Calcium then more Magnesium must be added to the programme. If the Magnesium is more than 50% of the Calcium then Calcium must be added.

It must be noted that in certain parts of the RSA the figure for calcium can be so high that it would be impractical to try to bring the other nutrients to that level

Total Area of Particles - The GKL must remember that as these anion sites are on the surface of the particles it follows that the larger the total surface area of a given volume of soil the greater the number of anion sites.

Although sand particles are larger and will each have a greater surface area there are so many small particles (eg Clay) that the total surface area of clayey soil is much larger than the total area of sandy soil in the same volume – therefore clay soils will have a higher C.E.C.

Organic Matter Organic matter eg. Compost Pine Bark have a very high C.E.C because of the large number of anion sites in such matter.

Examples of different C.E.C.'s - Sandy soils = 0 – 8: Clayey soils = 20 – 40. :

Organic Matter Peat = 50 -70, Humus = 100-200, Sterile Treated Pine Bark = 278

From the above it might be deduced that it might be more advantageous to have clayey soils on the bowling green but there are other factors which have to be considered before the GKP can import clay on to his green. eg the slow drainage would restrict deep rooting and create stressful conditions conducive.

It would be much more advantageous to mix compost or other organic material with sand - such a combination would not only allow good drainage but still have the high C.E.C. to allow all the cations applied as fertilisers to find anion sites on the compost.

Silica Sand In many of our cities Silica Sand is available as a top-dressing for sports turf. It must be pointed out that Silica Sand is completely inert with a very low C.E.C.. If used for a number of years the upper layers of the green would not be able to retain the cations of the fertilisers because of the absence of negatively-charged anions. The GKP should, always, insist on the silica sand being supplied with about 20 – 39 % compost

The C.E.C. will give the GKP an indication of how much compost should be added to the Silica Sand.

Frequency of Fertilising

No GKP would like to feel that some of the fertilisers he is applying to the green is being leached out because there are too few negatively – charged anions to take up all the cations of the fertilisers he has applied to the green.

A guideline to the frequency of fertilizing would be – C.E.C.

Below 10 - Apply fertlisers every week.

10–20 – Apply fertilisers every 2weeks.

Above 20 - Apply fertilisers every month.

Base Saturation - This figure indicates to what extent the cations of Calcium, Potassium, Magnesium, and Sodium have taken up all the available anions in the soil sample – it is given as a percentage

It will give an indication of how closely nutrient status approaches potential fertility.

A low figure can indicate that some of the elements are being leached out **before** the roots can absorb them or that such a large volume of fertilisers are being administered at one time that many of them are passing the negative anions without being able to attach to them

Organic Carbons Some Labs will test for Organic Carbons. This is an indication of the amount of organic matter present in the soil sample. As shown above in C.E.C the presence of organic matter in sandy soils will increase the C.E.C. of the soil to an acceptable level - the Organic Carbons should be above 2 %

Phosphorous

The first element appearing on the Report will be Phosphorous (P). It is not included in the tests for C.E.C.

Tests for Phosphorous - Laboratory teats for Phosphorous can be very confusing for the GKP. The fact that there are so many is an indication that not one of them is so far superior that the others can be discarded. It is important that the Laboratory indicates which test is used.

The tests commonly used in the RSA are Bray 1 or 2 , Olsens, Citric, and Colwell.

As a rule it is normally accepted that the concentration of Phosphorous will be higher in the coastal regions of South Africa than inland. In fact, there are many regions where the P concentration is well above the normal limits but in most instances the P is so bound with the soil that it is not available to the grass plant.

P can only be applied during renovation after scarifying. P is not easily absorbed when applied on a grassy mat.

While the GKP should take note of the figures supplied by the Lab he could safely apply 25 Kgms of 3:1:5 at the coast and 2:3:2 inland annually at renovation.

Other Elements

The so-called micro-elements are only micro because they appear in small quantities in the soil but this does not detract from their importance.

Most labs will include them in the report. They are Copper, Zinc, Manganese, Boron, and Sulphur – Manganese will, normally, be included in the monthly fertiliser programme.

The rest can be applied collectively in a Trace Element mixture.

Texture Some Labs will only indicate whether the sample was sandy, loam, or clayey others will submit a full Particle Size Analysis.

Soil will tend towards coarse, medium, or clayey eg. One would not get coarse and medium sand with 15 – 20% of clay/silt.

Ideally the texture should be about 10% finer than U.S.G.A specifications with the major part of the test leaning towards medium sand.

Clay and silt combined should not comprise more than 16 % of the whole. Such soils would need amending with coarser sand

At the other extreme a clay/silt percentage of less than 6 % would suggest freedraining sandy soil with a C.E.C. less than 3 and deep roots. The only remedy here would be frequent hollow-tining and filling the hollows with compost or other organic compounds.

Obtaining the Sample

The soil sample should be representative of the whole green. The GKP should obtain a sample from the middle of the green and from the four corners – i.e about 10 metres in from the corner. The total weight should be 2.00 Kgm.

The sample should preferably be obtained in the winter some time after the last fertilising.

The GKP should select a reliable Lab specialising in Sports turf. Some labs are more agriculture orientated and tend to prescribe for crops thriving in alkaline soils.

Having selected a Lab the GKP should stick to the same one.

Comments When I was still practising medicine I wrote out numerous prescriptions for the patients . At the time my concern was –

1 Would the patient actually have the script made up at the pharmacy. -
2 Would he take the medicine exactly as prescribed. – T
3 Would he complete the coarse.
4 Would his body absorb the medicine and convey it to the affected part eg no allergies

The same applies to a GKP fertilising the green.

1 Will he purchase all the fertiliser that has been prescribed
2 Will he apply it as prescribed –
3 Has he taken the –
   - C.E.C
   - pH
   - Texture of the soil into account
4 Will some of the fertiliser be leached out before it can be absorbed

Conclusion The Soil Analysis contains an enormous amount of information. It is up to the GKP to take note of how much of the info tends to be corroborated by other tests.

He should avoid applying any fertilisers until he has had the opportunity to rectify the basic soil physics which might predispose to a mal-absorption and wastage of the fertilisers.

I hope this article will encourage the GKP to look intelligently at the Soil Report and not just confine it to a file.

– Good Luck