Field techniques
Understanding soil test reports

By Christopher Sann

Soil test reports vary considerably from one testing lab to another. Rather than use a particular lab's test report as an example, we have incorporated features from several labs' reports for the following sample report.

Each test result is listed with its unit of measurement and a recommended action for each result. There is a key explanation at the end with a brief description of each result.

Explanation of a typical soil test report

1. Soil pH is the active acidity of the sample. It measures the hydrogen ion concentration in the soil solution, and it allows you to estimate the availability of all nutrients and the distribution of the major cations held on exchange sites.

2. Buffer pH is the reserve acidity of the sample. It measures the hydrogen ion concentration on the exchange sites and indicates how resistant the soil is to pH change.

3. C.E.C. or cation exchange capacity is a numerical expression of the quantity of

TYPICAL SOIL TEST REPORT

XYZ Soil Testing Laboratory
123 Main Street • Anytown, USA

Run For: Al Ways Ready, Supt.
14th Lost Ball Road
Big Swing, PA

Site name: 9th & 10th Fairway
Species: Bentgrass

Test	Result	Units	Range	Recommendations
1. Soil pH	5.9*		6.3-6.5	30 lbs. calcitic limestone/1000 ft.2/year
2. Buffer ph	6.8*		6.9-7.1	See soil pH recommendations
3. C.E.C.	12.3	meq/100g	3.0-40+	Loamy to sandy
4. Phosphorus	22*	ppm	28-32	1.0 lb. P2O5/1000 ft.2/year
5. Potassium	65*	ppm	120-200	2.5 lbs. K2O/1000 ft.2/year
6. Magnesium	215	ppm	varies by C.E.C.	see soil pH recommendations
Calcium	850*	ppm	varies by C.E.C.	See soil pH recommendations
Sodium	32	ppm	>50	none
7. % H Base Saturation	30.5*	%	>5%	See soil pH saturation recommendations
% K Base Saturation	01.8	%	varies by C.E.C.	See potassium saturation recommendations
% Ca Base Saturation	45.5*	%	65-75%	See soil pH saturation recommendations
% Mg Base Saturation	20.0	%	15-20%	None
% Na Base Saturation	02.2	%	0-5%	None

***Needs addressing**

meq/100g = milli-equivalents per 100 grams per soil   ppm = parts per million cations held in the soil matrix. C.E.C. measures the soil's nutrient holding capacity and is a strong indicator of soil texture and fertility.

4. Phosphorus is the amount of plant-available phosphorus in the sample at the reported soil pH. Phosphorus may be held in other unavailable and insoluble forms in the soil matrix, but plant-available is the only important number.

5. Potassium measures the amount of potassium that is plant-available in the soil solution and held on the exchange sites. Like phosphorus, potassium can also be held in other nonavailable forms.

6. Magnesium, calcium and sodium report the amounts of each of these elements in soil solution and held on exchange sites. These elements are the main components of the alkaline portion of the soil, and, although you can estimate pH from this information, a better picture can be obtained by looking at the percent base saturation for these elements.

7. Percent (%) Base Saturation (P.B.S.) for hydrogen, potassium, magnesium, calcium and sodium represent the distribution of each element relative to the total cation exchange capacity. These five major elements — combined with the minor elements — represent the total exchange capacity of the soil. From a practical standpoint, P.B.S. indicates how efficiently the plant-available forms of these elements are becoming available for plant use.

8. Soil pH recommendations (see tables below) are actually based on the buffer pH readings. The actual material recommended will depend on the balance that exists between calcium and magnesium. The amounts of these elements that are available at differing C.E.C. levels is less important than the ratio of calcium to magnesium.

Since magnesium is a stronger alkaline material than calcium, and calcium is more necessary than magnesium both for plant

Correcting pH and related deficiencies

1. LIMING RECOMMENDATIONS

If buffer pH is...	Add calcitic limestone*	Or hydrated lime
6.7-6.8	25 lbs./1000 ft.2	12.5 lbs./1000 ft.2
6.5-6.6	50 lbs./1000 ft.2	25 lbs./1000 ft.2
6.3-6.4	75 lbs./1000 ft.2	37.5 lbs./1000 ft.2
6.1-6.2	100 lbs./1000 ft.2	50 lbs./1000 ft.2
5.9-6.0	125 lbs./1000 ft.2	62.5 lbs./1000 ft.2
<5.8	150 lbs./1000 ft.2	75 lbs./1000 ft.2

* If percent base saturation magnesium levels are less than 10, use dolomitic limestone.

2. CORRECTING MAGNESIUM DEFICIENCES

...WITH SOIL PH GREATER THAN 6.0, USING EPSOM SALTS

If % Mg base sat. is...	Add lbs. magnesium*	Timing
<10%	1.0 lb./1000 ft.2	spring and fall
10-15%	0.5 lb./1000 ft.2	spring and fall
>15%	0	not applicable**

*Actual pounds of epsom salts applied per 1000 ft.2 will vary, depending on the percentage of magnesium in the epsom salts.

** Usually with soil pH greater than 6.0 but less than 7.0, low calcium levels require gypsum applications.

3. CORRECTING CALCIUM DEFICIENCIES

...WITH SOIL PH GREATER THAN 6.0, USING GYPSUM**

If Ca base sat. is...	And %Mg base sat. is...	Add gypsum
<800 ppm 20%	10-15 lbs.	
<600 ppm 20%	15-25 lbs.	
<500 ppm 20%	25 lbs.*	

*May require multiple applications and should be monitored closely.

** Corrective application can be made anytime two weeks prior to, or after, a fertilizer application.

4. CORRECTING HIGH SOIL PH

...GREATER THAN 7.0, USING SULFUR

If soil pH is ...	And turf length is ...	Add sulfur ...	Timing
> 7.0	very short	100-200 lbs./A	spring and fall**
>7.0	short-tall	200-400 lbs./A*	spring and fall**

* Do not exceed 200 lbs./acre per application on sandy soils.

** Make multiple applications if necessary, and monitor soil pH two to four weeks after application. Do not apply during a period two weeks before or after a fertilizer application, as a rapid pH change can cause some nitrogen sources to volatize.

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nutrition and soil stability, a ratio of 6-8 parts calcium to one part magnesium is desirable. Soils low in soil pH, calcium and magnesium will require a dolomitic limestone. Soils low in soil pH and calcium, but with good magnesium levels will require calcitic limestone or hydrated lime applications. Soils with good soil pH, but low in either calcium or magnesium will require gypsum or epsom salts applications respectively.

—Editor's note: This is reprinted from TurfGrass Trends, November/December 1992.

Forget the Tea Leaves, Read the Soil Cores Instead

When you are taking soil samples, take a few minutes to take the next step: Examine the soil cores that you have taken and record your observations. If you take the soil samples at the same time each year and you make and record the same observations each year, you will develop an ongoing data source that will give you a strong indication of the effectiveness of your soil chemistry monitoring and correction activities, the success or failure of your thatch control strategies and the outcome of your efforts to grow and protect your turf's root structure.

The time you use to take soil samples is an excellent time to monitor the success of your other turf management efforts. Recording observations on the health of your soil and the plants that grow in it can pay major benefits in as little time as a year. You can examine the core samples for thatch depth, condition and level of decomposition, root mass, distribution and health, soil layering, compaction and pan formation and soil structure, particle size and distribution, and pore space size and quantity.

These observations of the current physical soil conditions combined with the results of the soil testing should give you valuable data for making a decision.

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CORE SAMPLE OBSERVATION FORM

SITE ______________	**FACILITY** ______________
LOCATION ______________	**STREET** ______________
DATE ______________	**CITY** ______________
TAKEN BY ______________	**STATE** ______________

▶ Thatch

Depth _____ (mm/in.)		**Condition**	dry _	normal_	wet _
Root invasion	none_	light_	medium_	heavy _	
Decomposition	none_	25%_	50% _	75% _	100%_

▶ Roots

Mass	thin _	medium_	dense _
Depth___(mm/in.)			
Distribution	poor _	fair _	good _
Color	white _	tan _	dark _
Health	vigorous_	static _	damaged_

▶ Soil structure

Compaction	starts at__ (mm/in.)		ends at__ (mm/in.)
Compaction density:	light _	medium _	heavy _
Layering:	starts at__ (mm/in.)		ends at__ (mm/in.)
Layering material:	stone _	clay _	organic _
Layer density:	light _	medium _	heavy _
Pan formation:	starts at__(mm./in.)		ends at__(mm./in.)
Particle size:	fine _	medium _	coarse _
Particle distribution:	uniform_	migrating_	stratified_
Pore space size:	small _	medium _	large _