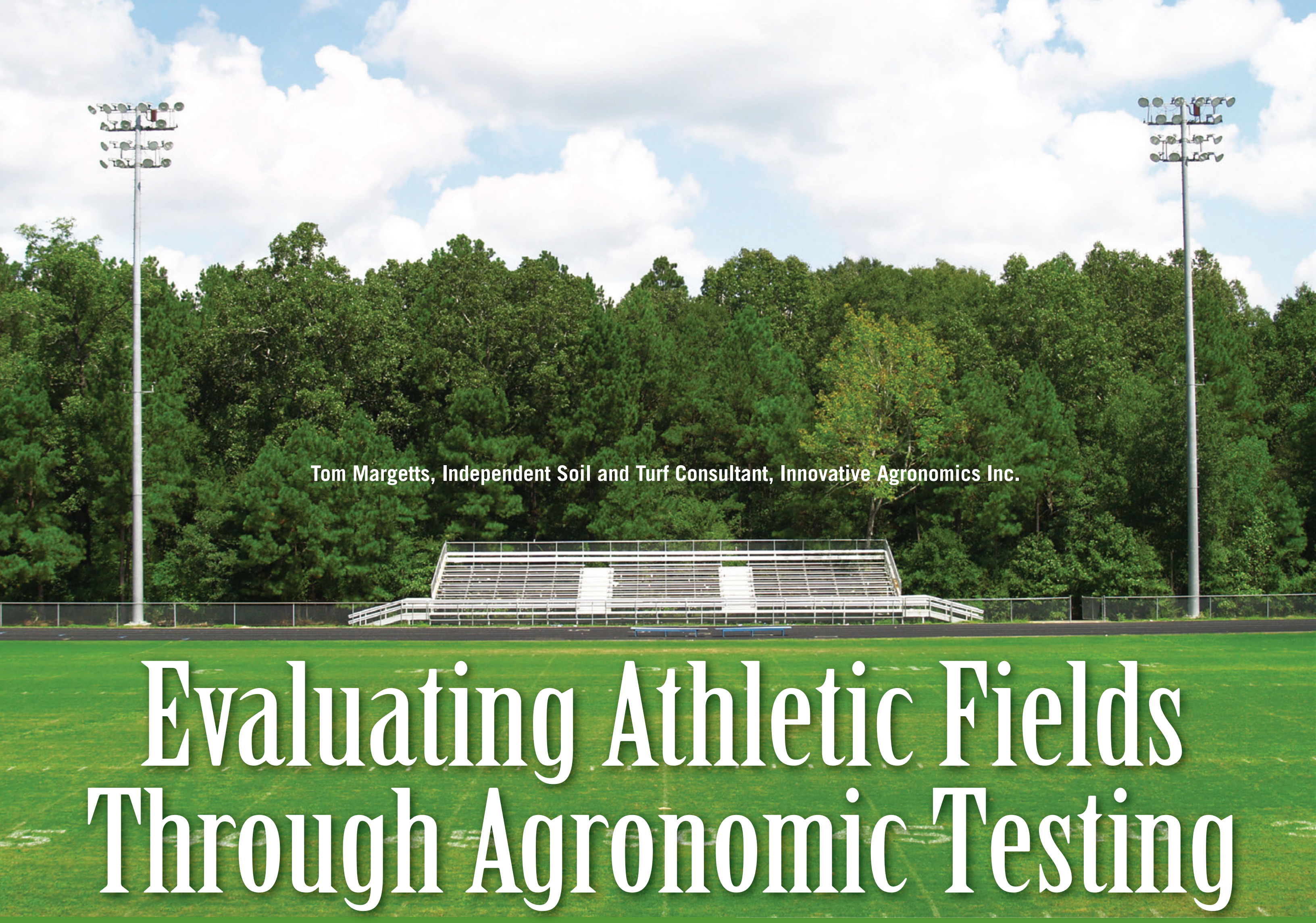

Tom Margetts, Independent Soil and Turf Consultant, Innovative Agronomics Inc.

Evaluating Athletic Fields Through Agronomic Testing

You Can't Manage What You Don't Measure

Rushing an athletic field project without a true understanding of your goals and objectives can often times end in a disappointing result.

Too often athletic field construction is treated in this way. We meticulously generate and review tender documents and review contractor proposals without really considering the destination or how this new field will fit into our program.

Many fields already exist in the turf manager's inventory. Few inventories contain the necessary information to allow them to be placed in a realistic classification system. Such an inventory system should permit an evaluation of how each field fits into an overall use program.

There are many challenges when it comes to field turf management and "hours of use" is definitely at the forefront. The physical components (sand, silt, clay) of an athletic field root zone are directly related to its ability

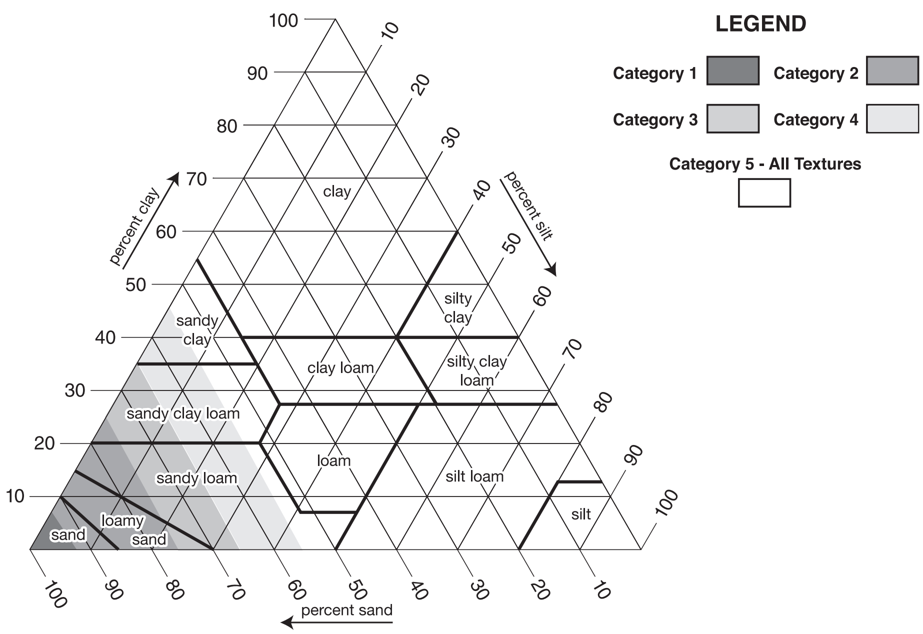

Figure 1. Use of the textural triangle to assign root zone soils to the field categories based on the particle size of the soil. *Athletic Field Construction Manual*, Sports Turf Association, 2012.

to withstand traffic and determine to a large degree its tolerable "hours of use".

The following discussion is geared towards information which can be gathered from existing fields for greater understanding of how to get the most out of the athletic fields you currently manage. "You can't manage what you don't measure" and now is the time to evaluate athletic fields to get a true understanding of what is realistic and what isn't. Agronomic testing strategies from an accredited laboratory can provide accurate information and allow making of the decisions required.

There are many components that go into an athletic field evaluation and placing the field in the appropriate category as defined in the Sport Turf Association's *Athletic Field Construction Manual* (Figure 1). Many of these can be determined and supported through independent laboratory testing and professional interpretation.

Physical Soil Testing

Understanding the physical components of the athletic field root zone will allow putting a program in place specific to the field's potential and limitations. Physical testing is a laboratory audit to determine the size of the particles that make up the root zone and the ratio in which they are found (Figure 2). The determination of sand, silt and clay with total silt plus clay can be related back to the field's:

- ability to tolerate traffic
- level of maintenance required
- recovery from rain events and inclement weather
- drainage capabilities
- potential for compaction
- ultimately determine tolerable "hours of use"

Each physical particle of the root zone has a size related to it. The ratio in which the different sized particles are found is

Brookside Laboratories, Inc.

**** PHYSICAL ANALYSIS REPORT ****

File Number : 53747
** Date of Analysis **
Start Date : 6/3/2010
Completed : 6/7/2010

Submitted By: Innovative Agronomics Inc. Reviewed by:

Lab Number 0578
Sample Description

1

Particle Size Analysis			USGA Specs
Clay <.002mm	%	5.3	<= 3.0%
Silt .002mm - .05mm	%	27.9	<= 5.0%
Sand .05mm - 2.00mm	%	65.3	
Gravel > 2.0mm	%	1.5	
Org Mat (360 deg C ash)		4.51	

Sand Fractions

Sieve Size #	mm		% Retained	
10 -	2.0	Fine Gravel	1.5	2.0mm <= 3.0%
18 -	1.0	Very Coarse Sand	3.4	2.0mm + 1.0mm <= 10%
35 -	.500	Coarse Sand	7.9	
60 -	.250	Medium Sand	18.4	0.5mm + 0.25mm >= 60%
100 -	.150	Fine Sand	15.4	0.15mm <= 20%
140 -	.106	Very Fine Sand	8.6	0.106mm + 0.053mm <= 5.0%
270 -	.053	Very Fine Sand	11.6	

Figure 2. Laboratory Physical Analysis Report

CATEGORY	PERMITTED DAYS	PERMITTED HR/DAY	PERMITTED HR/SEASON	CONSECUTIVE DAYS OF USE
1*	90	5	450	2
2	110	5	550	3
3	140	5	700	4
4	180	2.5	450	4
5	180	2.5	450	5

Figure 3. A guideline for the permitting hours of the five categories of athletic fields. *Athletic Field Construction Manual*, Sports Turf Association, 2012.

BASICALLY, EVERY ASPECT OF A TURF MANAGEMENT PROGRAM SHOULD BE CONNECTED TO THE PHYSICAL MAKEUP OF THE ROOT ZONE.

directly related to the amount of pore space the root zone has. All root zones are made up of a percentage of capillary (micro) pores and non capillary (macro) pores. Sand based fields (Category 1) will have a high percentage of non capillary pores which allows them to be free draining, resist compaction and have a low nutrient holding capacity. This almost always translates into higher maintenance. Soil based root zones will have a higher percentage of capillary pore space that will hold water for a longer period and provide a more nutrient rich environment for turf growth.

Basically, every aspect of a turf management program should be connected to the physical makeup of the root zone. It requires knowledge of a field's ability to tolerate inclement weather in relation to drainage, how prone it is to compaction and its porosity. Physical testing and interpretation can provide these answers and can save both time and money in your turf programs.

Hours of Use

The physical components of the root zone are directly related to tolerable "hours of use". Most municipal athletic

lb/A

BROOKSIDE LABORATORIES, INC. 54581-5

SOIL AUDIT AND INVENTORY REPORT

Name

City

State

Independent Consultant Innovative Agronomics Inc.

Date 5/19/2011

Sample Location					
Sample Identification		QUAD 1 d 6 in FIELD 1	QUAD 1 d 6 in FIELD 3	QUAD 2 d 6 in FIELD 1	QUAD 2 d 6 in FIELD 3
Lab Number		0517-1	0518-1	0519-1	0520-1
Total Exchange Capacity (ME/100 g)		14.04	15.68	15.36	14.10
pH (H_2O 1:1)		a 8.0	a 7.9	a 8.1	a 8.1
Organic Matter (humus) %		1.47	1.95	1.66	1.73
Estimated Nitrogen Release	lb/A	49	59	53	55
ANIONS: SOLUBLE SULFUR*	ppm	27	33	36	27
PHOSPHORUS: MEHLICH III	lb/A P as P_2O_5				
	ppm of P				
PHOSPHORUS: BRAY II	lb/A P as P_2O_5				
	ppm of P				
PHOSPHORUS: OLSEN	lb/A P as P_2O_5	23	23	9	18
	ppm of P	5	5	2	4
EXCHANGEABLE CATIONS: CALCIUM*	lb/A	4620	5014	4960	4464
	ppm	2310	2507	2480	2232
MAGNESIUM*	lb/A	400	518	490	490
	ppm	200	259	245	245
POTASSIUM*	lb/A	140	166	158	162
	ppm	70	83	79	81
SODIUM*	lb/A	76	104	94	102
	ppm	38	52	47	51
BASE SATURATION PERCENT					
Calcium	%	82.26	79.94	80.73	79.15
Magnesium	%	11.87	13.76	13.29	14.48
Potassium	%	1.28	1.36	1.32	1.47
Sodium	%	1.18	1.44	1.33	1.57
Other Bases	%	3.40	3.50	3.30	3.30
Hydrogen	%	0.00	0.00	0.00	0.00
EXTRACTABLE MINORS					
Boron (ppm)		0.44	0.56	0.49	0.82
Iron** (ppm)		20	32	23	23
Manganese** (ppm)		< 1	< 1	< 1	< 1
Copper** (ppm)		1.29	1.58	1.36	1.37
Zinc** (ppm)		0.70	0.73	0.63	0.57
Aluminum (ppm)					
OTHER TESTS: Soluble Salts (mmhos/cm)					
Chlorides (ppm)					

* Ammonium Acetate Extractable (pH of 8.1)
** DTPA Extractable

d - specific depth

a - alkaline soil

Figure 4. Laboratory Soil Audit and Inventory Report.

fields experience high usage, potentially beyond their tolerance in relation to the maintenance program. Categorizing the athletic fields becomes very powerful information to deal with pressure from user groups, operating and capital replacement budgets. It provides the turf manager a tool to justify budget requests or defend how the conditioning matches quality.

For example, compare a sand based vs soil based root zone. *The Athletic Field Construction Manual* offers guidelines that indicate a Category 1 (sand based) field will tolerate 450 hours of use per season. The Category 3 (soil based) field will tolerate 700 hours of use per season (Figure 3).

This is where understanding the tolerable use is very important. Category 1 athletic fields are basically really big golf greens built to very tight specifications. They are designed to host a selected number of high level sporting events and be "game ready" quickly after inclement weather. They have a high amount of non capillary (macro) pores and can become unstable if the root matrix (tensile strength) is lost from the turf surface. This is not a situation a municipal turf manager needs to deal with in the middle of a busy season, without high inputs and resources.

Category 3 (soil based) athletic fields are the "work horse" of the bunch and have a better, well rounded soil structure. The Category 3 field has a good balance of capillary and non capillary pores for water holding capacity and adequate drainage. They will require less intensive maintenance and have the ability to withstand abuse under good preventative maintenance. However a soil based athletic field can be quickly destroyed if play or maintenance is allowed within a short period of time after heavy rainfall.

Root Zone Layering

Physical soil testing can also target layering issues within the root zone. Layering can result from inconsistent materials or on-site blending during the construction phase. Every time a layer is introduced in the root zone there is a reduction in the efficiency in which the soil drains and exchanges oxygen from the surface. Layering problems are also created as a result of improper topdressing material selection. The topdressing material should be compatible with the physical components of the root zone. Test the upper and lower portion of the root zone if layering is suspected and test the topdressing material as well. With professional interpretation this laboratory data can be brought together to determine the best corrective measures and topdressing program moving forward.

Incompatibility of sod is another source of root zone layering. This can occur from sodding during construction or ongoing repairs and renovations during the season. Sod with a finer soil component than the material below can create an unfavourable interface that holds water, promotes shallow rooting and creates a slippery, unsafe playing surface. Conduct physical soil testing to determine the sand, silt, clay and particle size analysis on your sod layer and compare it to the root zone material under it. You may be very surprised!

EXCESSIVE SOIL COMPACTION, POOR INFILTRATION AND OXYGEN CAN LIMIT THE BEST TURF PROGRAMS.

Nutritional Soil Testing

Proper soil chemistry is an important part of the success of a turf program. Independent nutritional soil testing can determine elements that are deficient such as phosphorus, magnesium, and potassium. They can also determine excessive values and strategies for reducing fertilizer inputs (Figure 4).

A soil test will not accurately measure nitrogen. Nitrogen is a very important component to turf growth rate and resiliency. Understanding the demand and reviewing past maintenance records will determine if Nitrogen rates are adequate. Testing frequency can vary; a client once said "If you are surprised by your soil test results, you likely aren't testing enough".

The Total Exchange Capacity (T.E.C.) of the root zone is a measurement of the root zone's ability to hold nutrients. This information will be found on most nutritional soil test results. Soil based root zones typically have a much different T.E.C. than sand based root zones. This information can assist the turf manager in determining how the elements should be applied in order to get the most out of the fertilizer program.

Compaction Testing

Excessive soil compaction, poor infiltration and oxygen exchange can limit the best turf programs. Athletic fields get used and they get used a lot! Research suggests that a root zone in excess of 300 psi taken from a penetrometer (compaction meter) will hinder root development. Aeration and cultural practices are extremely important in an athletic field program. Understand the root zone compaction at the surface and different interval depths. Subsurface compaction layers can go unrecognized without an evaluation with this type of equipment. The physical components of the root zone will be either resilient or prone to compaction. Over compaction from maintenance or use shortly after a rain event "squeezes" the soil particles together, destroys the soil structure and reduces the size and amount of pore space. As a result there is a loss in the balance of air and water creating a poor environment for root health. The result will be weak turf and the remedy will need to be deep tine aeration.

Summary

"You can't manage what you don't measure", so collect the information and make the necessary changes to your cultural management. Fit the information for each field into one of the categories described in the *Athletic Field Construction Manual* and establish a file of the data for each field. From this information establish the tolerable "hours of use", the maintenance required and the potential problems of drainage and compaction. •