» **THE 25,000 SEAT** Red Bull Arena, located on the Passaic River north of Newark, NJ, is considered state-of-the-art for soccer stadiums in North America.

A soil profile: Red Bull Arena

The Soil Profile is a quarterly interview series that will be accompanied by soil test audits of a selected field from all corners of the sports turf world. Our goal is to evaluate the soil and water tests from a selected sports field and build a fertility program based on the soil profile. We encourage any sports field managers who would like to be interviewed for this piece to contact the editor at eschroder@m2media360.com. Joel Simmons is an agronomist who has been building soil based programs for more than 20 years. Along with Logan Labs he will provide free soil test work and consulting to the selected site.

DAN SHEMESH is the Director of Grounds at the new Red Bull Arena in Harrison, NJ, home of the Major League Soccer New York Red Bulls. Dan holds a degree in turf management from Penn State and after graduation had the opportunity to work with Tony Leonard at the Philadelphia Eagles' Lincoln Financial Field.

The stadium opened its doors March 20 and the schedule does not slow down much until the end of the fall and will include 15 home games for the Red Bulls, a number of international games, NCAA games and even a few

Water Analysis Report

pH	7.6			
Hardness ppm	61.8			
Hardness Grains	3.61			
Conductivity mmhos/cm	0.31			
Sodium Adsorbtion Ratio	1.28			
		ppm	**MEQ/L**	**lbs/A IN**
Calcium	Ca	16	0.80	3.64
Magnesium	Mg	5.3	0.44	1.20
Potassium	K	1.2	0.03	0.27
Sodium	Na	29.6	1.29	6.74
Iron	Fe	0.3		0.08
			MEQ/L	**lbs/A IN**
Total Alkalinity		43.0		9.77
Carbonate		0.0	0.00	0.00
Bicarbonate		52.0	0.85	11.82
Chloride		20.0	0.57	4.55
Sulfate		20.6	0.43	4.68
Salt Concentration		198.4		45.09
Boron		< 0.02		
Cation/Anion Ratio			1.38	

Figure 1

rugby matches not to mention a possible concert or two.

The field was built in the summer of 2009 and constructed with a 90/10 mix of sand and peat moss. The grass is 100% Kentucky bluegrass and was laid as sod last fall. One of the biggest challenges that Dan will face is the stadium itself in that the overhang structure does not allow for much in the way of air movement, light penetration or adequate rain fall to help flush the field. Adding to this problem is a very poor irrigation water supply that will deposit sodium and bicarbonates into the rootzone every time the irrigation system is turned on and because of the overhang a lot of hand watering in perimeter parts of the field is going to be a necessity.

When evaluating a water sample we focus on a number of issues but are really trying to determine if there are any "red flags" in that water that are going to affect growing conditions (see Figure 1). Unfortunately the water sample from Red Bulls Stadium is rich in sodium. The water test identifies the MEQ/L (milli-equivalents per liter of water) which compares the amount of basic cations (calcium, magnesium, potassium and sodium) to each other; in this sample sodium makes up 50% of that relationship and as can be seen on the soil tests the sodium is being deposited into the soil profile.

This much sodium constantly being irrigated into the rootzone will affect soil structure and can create a situation known as sodium induced wilt where sodium enters freely into the cell of the plant creating tremendous stress and a wilting situation. This type of wilt is often mistaken by turf managers as an environmental wilt and more water is applied to overcome it, clearly in this case adding more sodium to the rootzone is not the best answer.

The strategy to prevent this problem without treating the water is to build flushing programs that would include soluble forms of calcium like gypsum and perhaps a good liquid calcium product. Gypsum applications for this field would be recommended at low rates (5-10 lbs/1000 sq ft) monthly along with a good penetrating wetting agent and possibly a rich humic acid-based soil conditioner. These products would be heavily watered through the soil to help keep the sodium at bay.

The standard soil test (Figure 2) on this site allows us to build a strategy to improve the soil profile and better feed the plant material. As can be seen on the soil test this site is lacking in most everything, not at all untypical of a new sand-based field. The basic cations of calcium, magnesium and potassium are all deficient and products like sul-po-mag, potassium sulfate and a small amount of either high calcium or dolomitic limestone could all become a part of this program.

Phosphorous is also a weak link here and with the stress factors of high sodium and poor nutrient mobility the plants demand for energy increases quite substantially and if phosphorous availability is poor the stress factors to the plant increase. Remember that phosphorous is the "energy molecule" as described by the Krebs Cycle and if phosphorous is not available many of the most basic physiological functions become difficult for the plant to perform.

I like to recommend MAP, the least reactive (and therefore the least likely to tie up) of the soluble phosphorous sources along with small amounts of rock phosphates to provide both solubility and sustainability especially in sand fields. Although rock phosphates may be criticized for not being soluble it will provide a sustainable foundation in the soil (or in this case the soil less medium) where the plant can dissolve the mineral on a steady basis as it needs phosphorous.

Organic matter is very low in this field as well and this needs to improve in order to build soil buffers for water, temperature and to help build a better environment for beneficial micro-

Soil Report

Sample Location			**RBA**
Sample ID			
Lab Number			**26**
Sample Depth in inches			**6**
Total Exchange Capacity (M. E.)			**3.75**
pH of Soil Sample			**6.10**
Organic Matter, Percent			**0.56**
ANIONS	SULFUR	p.p.m.	**13**
	Mehlich III Phosphorous:	as (P_2O_5) lbs / acre	**210**
EXCHANGEABLE CATIONS	CALCIUM: lbs / acre	Desired Value	**1020**
		Value Found	**913**
		Deficit	**-107**
	MAGNESIUM: lbs / acre	Desired Value	**200**
		Value Found	**124**
		Deficit	**-76**
	POTASSIUM: lbs / acre	Desired Value	**200**
		Value Found	**76**
		Deficit	**-124**
	SODIUM:	lbs / acre	**73**
BASE SATURATION	Calcium (60 to 70%)		**60.81**
	Magnesium (10 to 20%)		**13.76**
	Potassium (2 to 5%)		**2.60**
	Sodium (.5 to 3%)		**4.20**
	Other Bases (Variable)		**5.20**
	Exchangable Hydrogen (10 to 15%)		**13.50**
TRACE ELEMENTS	Boron (p.p.m.)		**0.41**
	Iron (p.p.m.)		**95**
	Manganese (p.p.m.)		**7**
	Copper (p.p.m.)		**1.29**
	Zinc (p.p.m.)		**4.62**
	Aluminum (p.p.m.)		**140**

Figure 2

Spiking the surface of the field as often as possible to break the sealing affect of bicarbonates and sodium will be a huge plus and a carbon based fertility program can help to keep microbial activity high.

organisms. Low organic matter is very common again in these low CEC sand-based fields and it will improve as more roots slough off but if microbial activity is not active enough to constantly digest this ligneous organic matter thatch will build up and biological activity in the rootzone will suffer. Spiking the surface of the field as often as possible to break the sealing affect of bicarbonates and sodium will be a huge plus and a carbon based fertility program can help to keep microbial activity high. (See Figure 3 to see bicarbonates going down through the percentage of sodium.)

The water soluble paste test helps us better understand of what is on the soil colloid how much of it is actually mobilizing into the rootzone so that the plant can take it up. A good analogy here is the standard colloidal test is like a bank's long term CD account where the money won't be available for a period of time and the paste extract test is more like the checking account where money can be drawn on demand.

Here with Red Bull Arena we can see that calcium and magnesium are not mobilizing well. Ideally on this test we shoot for calcium solubility between 40-60 ppm's, magnesium between 8-15 ppm's and potassium between 7-20 ppm's. With this test we see calcium mobility below 20 ppm's and magnesium below 5 ppm's when using the irrigation water but even lower with de-ionized water, which better mimics rain water. This suggests that the plant will not get the needed calcium to build cell walls or enough magnesium needed as a foundation to the photosynthesis process.

These weaknesses can lead to plant stress and susceptibility to pest problems and affect the ability of the turf to recover from the level of play that will be seen on a field like this. Again, the granular applications of gypsum and sul-po-mag will help to provide a level of availability to the plant but a good liquid spray program consisting of NPK, Ca, Mg, traces and some liquid organics are suggested to help the plant get what the soil cannot provide. On low CEC sand-based fields small but frequent applications of all nutrients is important, small monthly applications of the soluble granular and bimonthly applications of the spray program has proven to be very effective.

Culturally a good spiking program is suggested to help keep bicarbonates from building up on the soil surface. Although the water does not show extremely high levels of bicarbonates with the physical pressures placed on a field like this one bicarbonates will build up and the soil surface will become sealed restricting air and water movement. This can lead to localized dry spots, poorer rooting and biological weaknesses affecting nutrient mobility. The soluble calcium program will help here but the use of wetting agents and the physical practice of spiking will help to keep the surface open and air moving through the soil profile. ■

Joel Simmons is the President of Soil First consulting and EarthWorks Natural Organic Products and can be reached at joel@soilfirst.com. Logan Labs is located in Lake View Ohio and can be found on the web at www.loganlabs.com.

Saturated Paste Report

	Sample Location			**RBA**
	Sample ID			
	Lab Number			**25865**
	Water Used			**RBA**
	pH			**7.4**
	Soluble Salts	p.p.m.		**219**
	Chloride (Cl)	p.p.m.		**35**
	Bicarbonate (HC03)	p.p.m.		**41**
ANIONS	SULFUR	p.p.m.		**18.41**
	Phosphorous:	p.p.m.		**0.85**
SOLUBLE CATIONS	CALCIUM:	p.p.m.		**17.98**
		meg/l	**0.90**	
	MAGNESIUM:	p.p.m.		**4.49**
		meg/l	**0.37**	
	POTASSIUM:	p.p.m.		**14.89**
		meg/l	**0.39**	
	SODIUM:	p.p.m.		**37.66**
		meg/l	**1.64**	
PERCENT	Calcium			**27.27**
	Magnesium			**11.34**
	Potassium			**11.73**
	Sodium			**49.66**
TRACE ELEMENTS	Boron (p.p.m.)			**0.03**
	Iron (p.p.m.)			**1.01**
	Manganese (p.p.m.)			**0.05**
	Copper (p.p.m.)			**< 0.02**
	Zinc (p.p.m.)			**< 0.02**
	Aluminum (p.p.m.)			**4.29**

Figure 3