
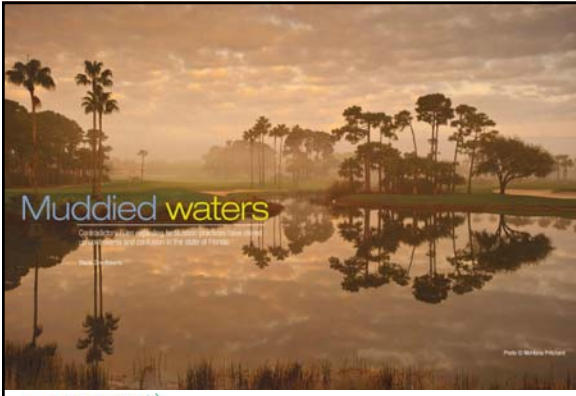



Advances in Turf Nutrition: *Moving Beyond the Norm*

Dr. J. Bryan Unruh
Extension Turfgrass Specialist
University of Florida/IFAS


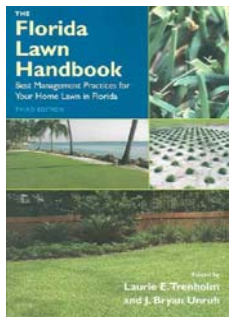



Muddied waters
Conducting a water quality assessment on your golf course is the only way to know if you are over-fertilizing.




Increased Scrutiny

- Environmental activist groups have momentum.
 - General public poorly understands the issues.
- Increasing level of scrutiny over what you do – even from those whom you consider allies (i.e., your members).
 - Some, knowingly and unknowingly, are working against the efforts of the green industry.
 - Work to educate your members about the importance of plant nutrition.

“Do not fertilize when rain is imminent.”

This statement has led to numerous fertilizer “black out” ordinances – typically May through October.



Increased Scrutiny *City of Rockledge Florida*

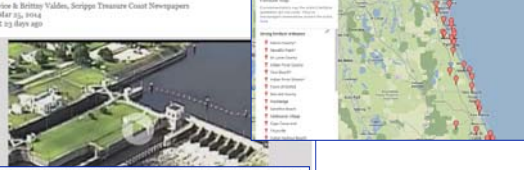


Mark Jacobs of *Save Our Aquifer* said: “We need to stop polluting the lagoon with lawn fertilizers. It is more important to have a healthy lagoon than to have unnaturally green turf grass. Many people I know have healthy turf grass and use no fertilizers; polluting the lagoon with lawn fertilizers is a completely senseless and unnecessary waste.”



Toxic Water: Stuart tables, Port St. Lucie passes tougher fertilizer laws to protect lagoon


BY: Paul Dine & Brittany Valdes, Scripps Treasure Coast Newspapers
POSTED: Mar 29, 2014
UPDATED: 20 days ago



Pierce also mentioned the golf courses that would be exempt from the restrictions.

Port St. Lucie Councilwoman Michelle Lee Berger said, “We can’t ignore the fact that golf courses do have a huge impact, but if we have an opportunity to improve 1 to 2 percent, that’s good.”

“Golf courses will spray more herbicides and pesticides than other people every year,” he said. “Why punish one industry and not the other?”



Trends in Nutrient Management Education

Nutrient Use Efficiency

- Generally defined as yield per unit input of fertilizer.
 - In turf, we don't measure "yield" directly.

4R Nutrient Stewardship

- Right Source** – Matches fertilizer type to plant needs.
- Right Rate** – Matches amount of fertilizer to plant needs.
- Right Time** – Makes nutrients available when plants need them.
- Right Place** – Keeps nutrients where plants can use them.

4R Nutrient Stewardship

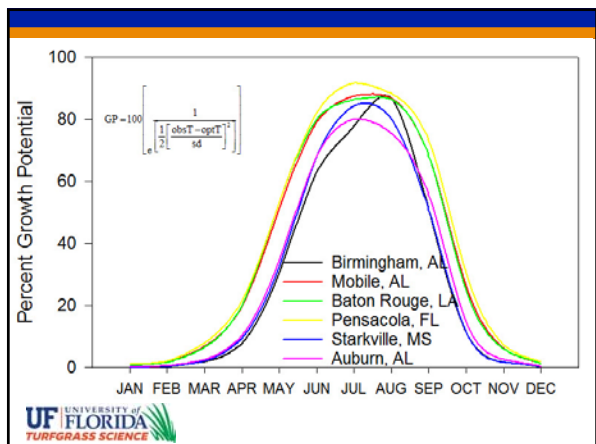
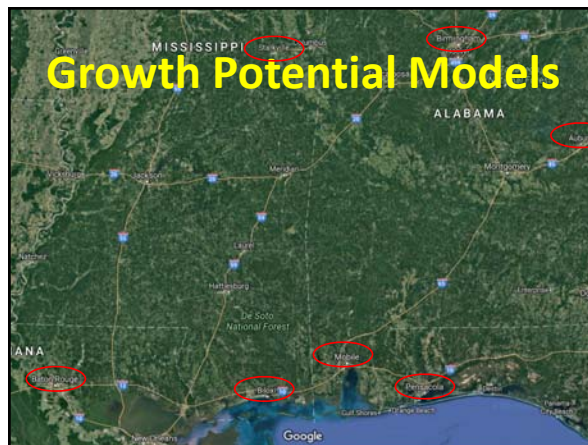
- Right Source
- Right Rate
- Right Time
- Right Place

– Source, time, and place are more frequently overlooked and may hold more opportunity for improving performance.




Trends

- Growth Potential Models
- Minimum Level for Sustainable Nutrition
- Soil Test Interpretations (or lack of)
- Tissue Testing

Warm-Season Turfgrass Fertility

	Birmingham, AL	Mobile, AL	Baton Rouge, LA	Pensacola, FL	Starkville, MS	Auburn, AL
lbs N 1,000 ft ²						
JAN	0.00	0.01	0.00	0.01	0.00	0.00
FEB	0.00	0.01	0.01	0.02	0.00	0.00
MAR	0.01	0.05	0.05	0.06	0.02	0.02
APR	0.06	0.15	0.15	0.16	0.07	0.08
MAY	0.23	0.38	0.40	0.40	0.24	0.26
JUN	0.47	0.59	0.60	0.62	0.51	0.51
JUL	0.58	0.66	0.65	0.69	0.63	0.60
AUG	0.65	0.65	0.65	0.66	0.60	0.57
SEP	0.38	0.51	0.51	0.55	0.38	0.42
OCT	0.09	0.20	0.19	0.23	0.09	0.11
NOV	0.01	0.05	0.04	0.05	0.01	0.02
DEC	0.00	0.01	0.01	0.01	0.00	0.00
	2.49	3.27	3.26	3.45	2.56	2.59



SLAN / BSCR / MLSN

- SLAN = Sufficiency Levels of Available Nutrients
- BSCR = Base Saturation Cation Ratio
- MLSN = Minimum Level for Sustainable Nutrition



13

RESEARCH

Clarifying soil testing: III. SLAN sufficiency ranges and recommendations

Robert W. Hale and Nick Upton

Soil nutrient levels have been reported through various methods and procedures. This research was conducted to determine the sufficiency ranges for soil nutrients in a healthy turf.

KEY POINTS

- Soil nutrient levels have been reported through various methods and procedures. This research was conducted to determine the sufficiency ranges for soil nutrients in a healthy turf.
- The sufficiency ranges for soil nutrients in a healthy turf are: Nitrogen (N) 10-15 mg/kg, Phosphorus (P) 10-15 mg/kg, Potassium (K) 10-15 mg/kg, Calcium (Ca) 10-15 mg/kg, Magnesium (Mg) 10-15 mg/kg, and Sulfur (S) 10-15 mg/kg.

Basic Cation Ratios for Sand-based Greens

Robert W. Hale and Nick Upton

The BSCR is used to estimate the relative amounts of base cations in the soil. The BSCR is calculated as follows: $BSCR = \frac{Ca + Mg + K}{Na + H} \times 100$

The BSCR is used to estimate the relative amounts of base cations in the soil. The BSCR is calculated as follows: $BSCR = \frac{Ca + Mg + K}{Na + H} \times 100$



14

Just what the grass requires: Using minimum levels for sustainable nutrition

Dr. Larry Stowell, Ph.D. and Dr. Wendy Gelernter, Ph.D.

Good turf performance can be achieved at lower nutrient levels.

Minimum Levels for Sustainable Nutrition guidelines

Element	Minimum Level (mg/kg)
Nitrogen (N)	10-15
Phosphorus (P)	10-15
Potassium (K)	10-15
Calcium (Ca)	10-15
Magnesium (Mg)	10-15
Sulfur (S)	10-15



GCM – Jan. 2014

15

What is MLSN?

- Minimum Level for Sustainable Nutrition (MLSN) is a new, more sustainable approach to managing soil nutrient levels.
 - Decreases fertilizer inputs and costs
 - Maintain quality and playability levels
- Developed by PACE Turf (Dr. Larry Stowell and Dr. Wendy Gelernter) and the Asian Turfgrass Center (Dr. Micah Woods).
 - All soil analyses were conducted at Brookside Laboratories.



16

The Goal of MLSN?


- “To provide a scientific and data-based approach to interpreting soil tests for turfgrass sites, making sure that there is a high probability of good turfgrass performance, while minimizing unnecessary application of fertilizer.”



17

What is MLSN?


- From a database of > 17,000 soil samples, 1,500 were selected that were classified as having:
 - Not poor performing turfgrass
 - **LOGIC:** If turf is good – nutrients likely aren't a limiting factor.
 - pH of 5.5 – 7.5
 - **LOGIC:** Accurate for a range of elements using the Mehlich 3 soil test extractant.
 - Cation Exchange Capacity < 6 cmol/kg
 - **LOGIC:** If there is enough of an element to produce good turfgrass in a low CEC soil, then the same amount will be sufficient in a nutrient-rich soil that has a higher CEC.



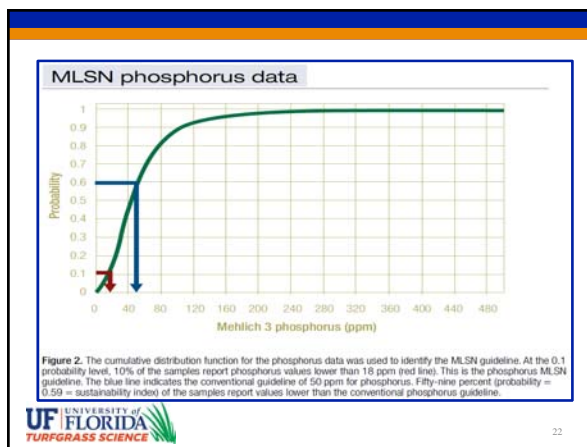
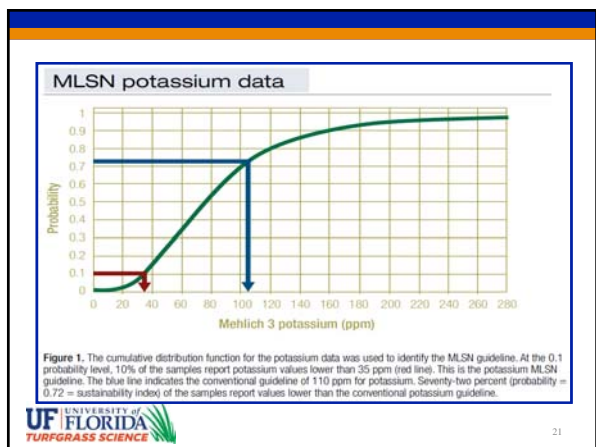
18

What is MLSN?

- Because all of these soils were producing good turf, one could conclude that all the soils had sufficient nutrients, so anything at or above those nutrient levels would be fine.
- Log-logistic model used to identify the concentration (in ppm) of each nutrient that 10% of the soil samples fell below – but were still performing well.
 - The 10th percentile value is the MLSN soil guideline.




19



Minimum Levels for Sustainable Nutrition Guidelines

Nutrient	Analytical Test	Conventional Guideline - SLAN (ppm)	MLSN (ppm)
Potassium	Mehlich 3	>110	37
Phosphorus	Mehlich 3	>50	21
Calcium	Mehlich 3	>750	333
Magnesium	Mehlich 3	>140	47
Sulfur	Mehlich 3	15 – 40	7



23

Learn More on **facebook**

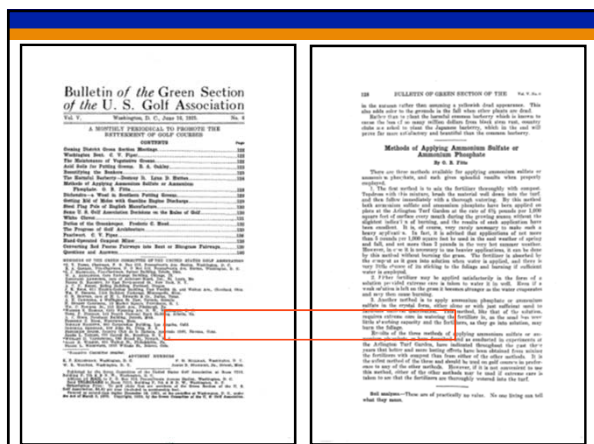


MLSN Turf

Community: Minimum Levels for Sustainable Nutrition - Turf nutritional guidelines for resource conservation


203 likes · 4 talking about this

203




What do we have evidence for?

- pH
- Salinity
- Partial evidence for:
 - Phosphorus
 - Potassium
 - Magnesium




P Recommendations

- Currently, phosphorus evidence does not provide a response prediction.
- When Mehlich III soil P is < 10 ppm, follow the recommended P applications rates for turfgrasses which is:
 - ≤ 0.25 lbs. of P per ap. & ≤ 0.5 lbs. of P annually



K Recommendations

- K evidence does not provide a response prediction.
- When Mehlich III soil K is < 30 ppm, follow the K recommendation for turfgrasses which is:
 - Apply K at ½ the rate of N with your normal N applications




K Recommendations

Quality

K Concentration


Figure 1. Turf quality of Tifgreen bermudagrass as influenced by N:K ratios (Snyder and Cisar 2000).

Figure 2. Potassium concentration in leaf tissue of Tifgreen bermudagrass as influenced by N:K ratios (Snyder and Cisar 2000).




Mg Recommendations

- Mg evidence does not provide a response prediction.
- When Mehlich III soil Mg is < 20 ppm, a response to Mg is possible but Mg rates are not available.



Which soil tests components are useful for Florida (SE US?) turfgrasses?


<p>Evidence for</p> <p>pH</p> <p>Salinity</p> <p>Sodicity (rarely important in Florida)</p> <p>P</p> <p>K</p> <p>Mg</p>	<p>Weak or No Evidence for</p> <p>All other components</p> <p>CEC</p> <p>Base Saturation</p> <p>OM</p> <p>S</p> <p>Fe</p> <p>Mn</p> <p>Ca</p> <p>Zn</p> <p>Cu</p> <p>B</p>
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USGA Green Section, 1994

Question: Do baseline tissue nutrient concentration levels exist for turfgrass?

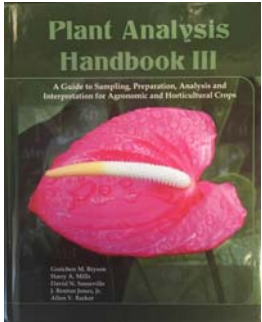

Answer: Unfortunately, no. Baseline nutrient levels for turfgrasses do not exist. Baseline levels refer to nutrient concentration within turfgrass plants that correspond to optimum development, growth and appearance. The nutrient concentration levels established for forage grasses were first used as the standard for turf, but one could question the use of forage standards in making decisions about turfgrass fertilization!



USGA Green Section 1994


Components

- Analysis
- Interpretation from correlation data
- Recommendations

Let's look at interpretation


<table border="1" style="width: 100%; border-collapse: collapse;"> <tr> <td style="width: 50%;">SCIENTIFIC NAME Cynodon dactylon x Cynodon transvaalensis 'TifEagle' ('TifEagle' Hybrid Bermuda)</td> <td style="width: 50%;">SCIENTIFIC NAME</td> </tr> <tr> <td>COMMON NAME TifEagle® Hybrid Bermuda</td> <td>COMMON NAME</td> </tr> <tr> <td>COLLECTED FROM Field test plots</td> <td>COLLECTED FROM</td> </tr> <tr> <td>PLANT PART Clippings from new growth</td> <td>PLANT PART</td> </tr> <tr> <td>SEASON Summer</td> <td>SEASON</td> </tr> <tr> <td>DATA TYPE Tissue</td> <td>DATA TYPE</td> </tr> <tr> <td>CULTIVARS USED TifEagle</td> <td>CULTIVARS USED</td> </tr> <tr> <td>Macronutrients</td> <td>Micronutrients</td> </tr> <tr> <td style="text-align: center;">%</td> <td style="text-align: center;">ppm</td> </tr> <tr> <td>N 2.01 - 3.33</td> <td>Fe 140 - 380</td> </tr> <tr> <td>P 0.25 - 0.40</td> <td>Mn 55 - 80</td> </tr> <tr> <td>K 1.10 - 1.65</td> <td>B 9 - 14</td> </tr> <tr> <td>Ca 0.56 - 0.71</td> <td>Cu 4 - 9</td> </tr> <tr> <td>Mg 0.18 - 0.30</td> <td>Zn 17 - 41</td> </tr> <tr> <td>S 0.35 - 0.46</td> <td>Mo 0.31 - 0.65</td> </tr> <tr> <td>SCIENTIFIC NAME Cynodon dactylon x Cynodon</td> <td>SCIENTIFIC NAME</td> </tr> </table>	SCIENTIFIC NAME Cynodon dactylon x Cynodon transvaalensis 'TifEagle' ('TifEagle' Hybrid Bermuda)	SCIENTIFIC NAME	COMMON NAME TifEagle® Hybrid Bermuda	COMMON NAME	COLLECTED FROM Field test plots	COLLECTED FROM	PLANT PART Clippings from new growth	PLANT PART	SEASON Summer	SEASON	DATA TYPE Tissue	DATA TYPE	CULTIVARS USED TifEagle	CULTIVARS USED	Macronutrients	Micronutrients	%	ppm	N 2.01 - 3.33	Fe 140 - 380	P 0.25 - 0.40	Mn 55 - 80	K 1.10 - 1.65	B 9 - 14	Ca 0.56 - 0.71	Cu 4 - 9	Mg 0.18 - 0.30	Zn 17 - 41	S 0.35 - 0.46	Mo 0.31 - 0.65	SCIENTIFIC NAME Cynodon dactylon x Cynodon	SCIENTIFIC NAME	<ul style="list-style-type: none"> • Sufficiency ranges are the low and high 'nutrient element concentrations for plants where deficiency, sufficiency, and toxicity levels have been established over a broad range of growing conditions' • Survey ranges are used when 'nutrient element concentrations have <u>not</u> been clearly identified as being either deficient or toxic'
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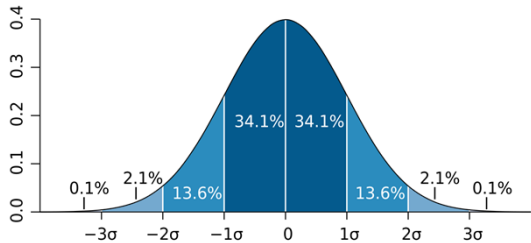

Plant Analysis Handbook III 2014

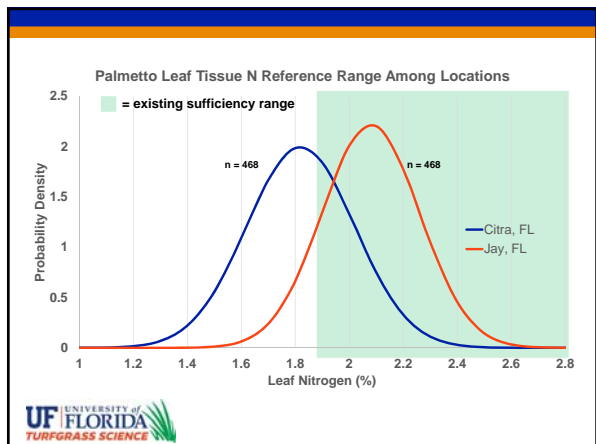
If tissue testing is of little value, what are we supposed to use?

- The UF Turfgrass Team is developing nutrient reference ranges for healthy turfgrass.
- Procedure is similar to the procedure established by the NIH for human blood.
- Analysis began in January, 2017 and will run indefinitely.



Turfgrass Nutrient Reference Ranges



www.gatorturf.com
<http://edis.ifas.ufl.edu>

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UF UNIVERSITY of FLORIDA TURFGRASS SCIENCE