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SFMA SPORTS FIELD MANAGEMENT ASSOCIATION

Pre-Conference Education Sessions

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Outline

- Why
- When
- What
- Soil Analysis
- General Recommendations

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Fertilizer Basics – Why Fertilize?

- Plants are living organisms and they require proper nutrition
  - Nutrition for plants comes in the form of fertilizer
- A properly fertilized turf is the best defense against plant pests
- A properly fertilized turf provides protection from storm water runoff
- “Proper” nutrition does not mean over-fertilization

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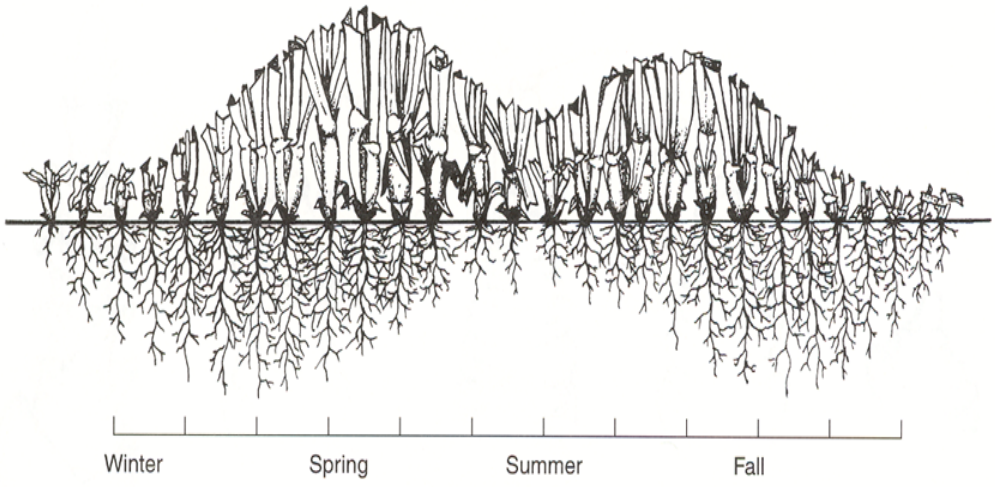
When to Fertilize?



Seasonal shoot and root growth of cool-season turfgrasses. (Turgeon, 2002)

Turgeon, A. J. 2002. Turfgrass Management

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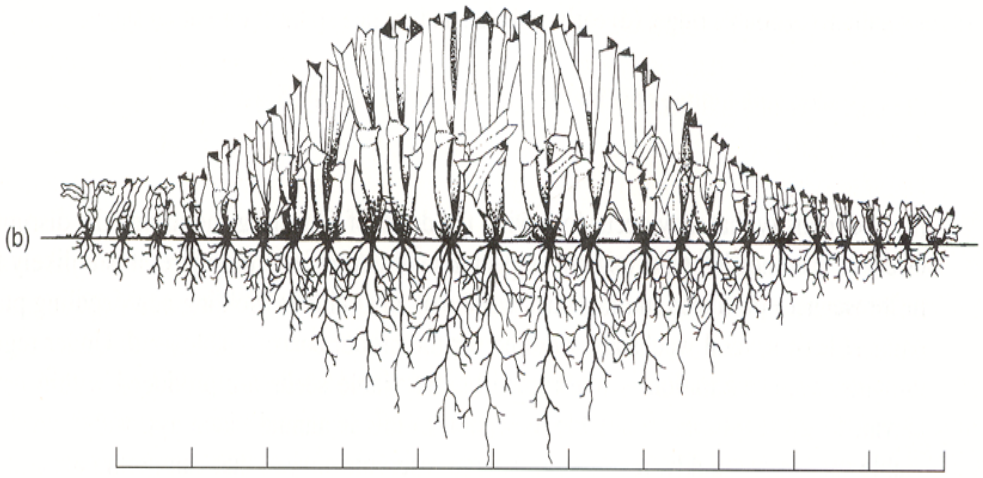
When to Fertilize?

Seasonal shoot and root growth of warm-season turfgrasses. (Turgeon, 2002)



Turgeon, A. J. 2002. Turfgrass Management

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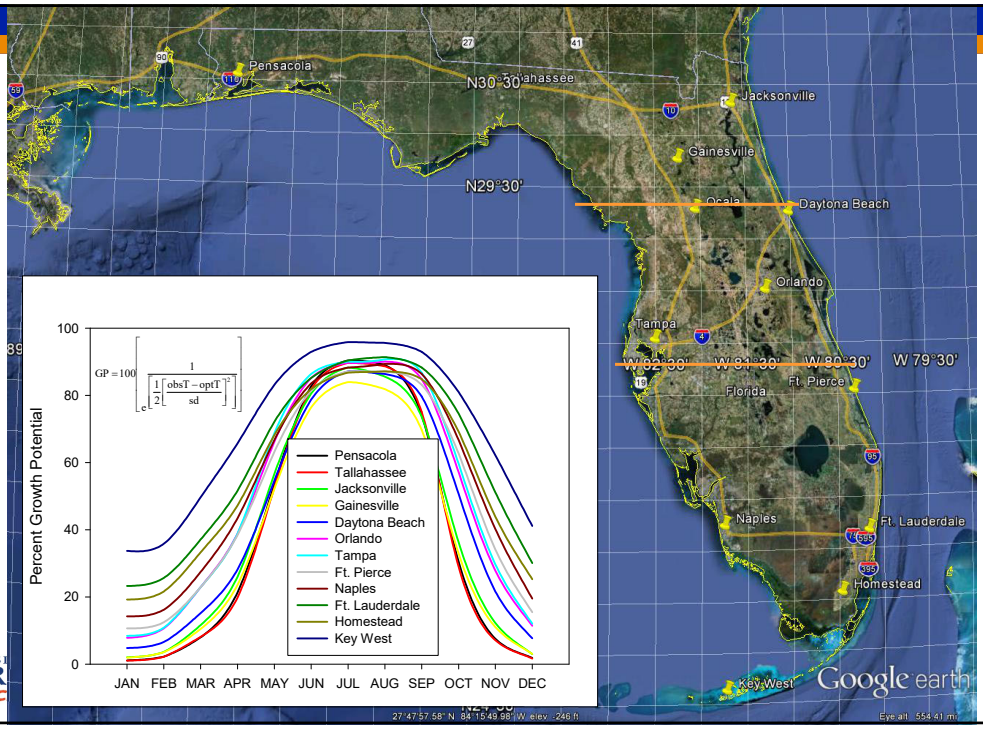
Growth Potential Modeling



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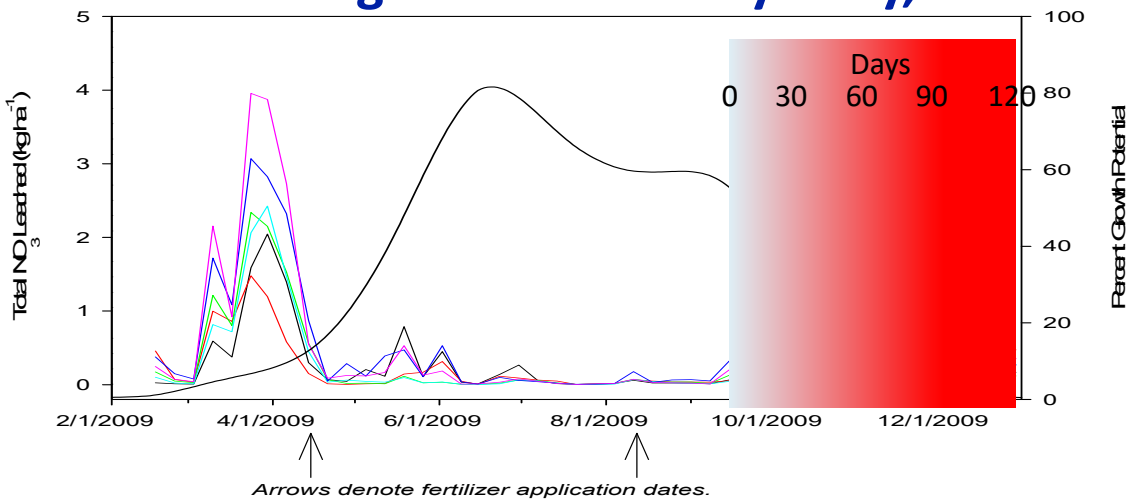
SR Nitrogen Source Study – Jay, FL



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17 Essential Elements

- **Carbon (C)**
- **Hydrogen (H)**
- **Oxygen (O)**
- **Nitrogen (N)**
- **Phosphorus (P)**
- **Potassium (K)**
- Sulfur (S)
- Calcium (Ca)
- Iron (Fe)
- Magnesium (Mg)
- Boron (B)
- Manganese (Mn)
- Copper (Cu)
- Zinc (Zn)
- Molybdenum (Mo)
- Chlorine (Cl)
- Nickel (Ni)

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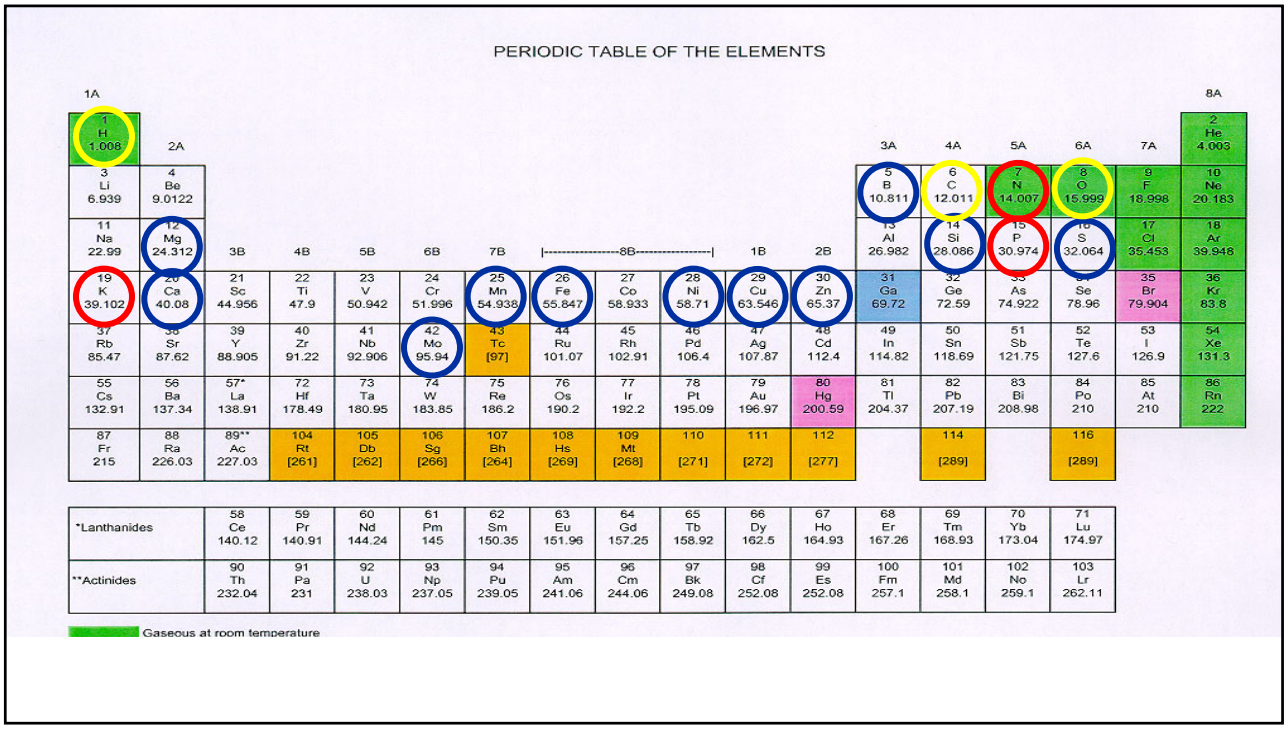

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Table 3. Essential plant nutrients with visual deficiency symptoms and plant tissue and soil test values.

Nutrient	Visual Deficiency Symptoms (all of these can result in poor shoot growth)	Typical Shoot Tissue Concentration[1]	Critical Soil Test Level[2]
Non Mineral Nutrients (obtained from air and/or water)			
carbon (C)	never deficient	43-48%	n/a
hydrogen (H)	never deficient	2-4%	n/a
oxygen (O)	shoots never deficient, but roots can be deficient in saturated (especially compacted) soils	43-48%	avoid soil moisture saturation for extended periods
Primary Macronutrients			
nitrogen (N)	chlorosis, significantly poor growth/ recovery (excessive nitrogen results in dark green color with excessive shoot growth/poor root growth)	3-4%	n/a (typical values are 5-10 parts per million [ppm] unless higher due to recent fertilization)
phosphorus (P)	poor root growth, in rare circumstances shoots will be red/ purple	0.25-0.45%	18-30 ppm
potassium (K)	chlorosis, lack of turgidity (shoots lay over)	2-3%	150-200 ppm
Secondary Macronutrients			
sulfur (S)	chlorosis	0.23-0.30%	n/a (less likely to respond to sulfur fertilizer as organic matter levels increase above 3%)
calcium (Ca)	lack of turgidity (shoots lay over)	0.5-1.0	400-500 ppm
magnesium (Mg)	chlorosis	0.25-0.50	80-100 ppm

Nitrogen (N)

BEST MANAGEMENT PRACTICES FOR THE SPORTS FIELD MANAGER: *A PROFESSIONAL GUIDE FOR ENVIRONMENTAL SPORTS FIELD MANAGEMENT*

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Nutrient	Visual Deficiency Symptoms (all of these can result in poor shoot growth)	Typical Shoot Tissue Concentration[1]	Critical Soil Test Level[2]
Micronutrients			
iron (Fe)	general chlorosis, although interveinal chlorosis is common in most species, this type of chlorosis is difficult to see or not present in shortly mowed turfgrass; it is rare to see deficiencies in newer varieties	65-500	n/a (very poor correlation to plant response)
zinc (Zn)	chlorosis	22-50 pm	>1-2 ppm
manganese (Mn)	chlorosis	35-60 ppm	6-10 ppm
copper (Cu)	chlorosis	5-8 ppm	0.4-0.6 ppm
boron (B)	chlorosis	8-15 ppm	>1-2 ppm
chloride (Cl)	chlorosis	unknown	>20-25 ppm
nickel (Ni)	not observed	unknown	unknown

[1]*Values shown are not intended to represent optimal ranges, but rather are what is commonly measured. Optimal levels vary by species, variety, use, and environment.*

[2]*The soil test values shown for the primary macronutrients have good confidence due to significant research, but the other nutrients have relatively less scientific backing and, instead, are based largely on observations and extrapolations with other species. The excessive soil test level shown is not meant to be a "sufficiency level", but rather the point at which there is virtually no chance that a fertilizer response would be likely.*

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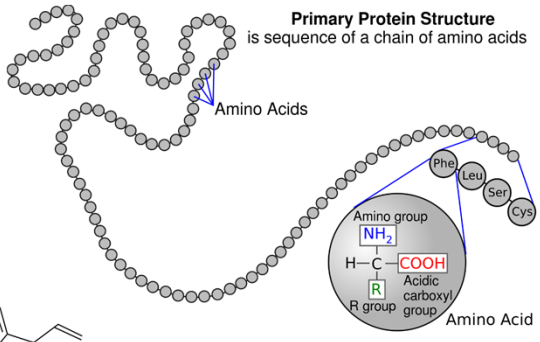
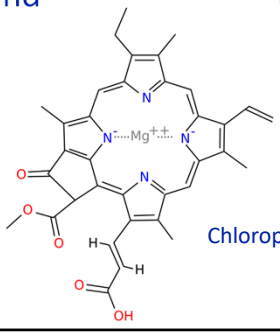
Nitrogen (N)

- For the most part, nitrogen controls the growth of turfgrass
  - Component of chlorophyll, proteins, amino acids, enzymes, hormones, and nucleic acids





Chlorophyll

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Nitrogen Influences:

- Color
- Shoot Density
- Root Growth
- Shoot Growth
- Carbohydrate Reserves
- Rhizome & Stolon Growth
- Temperature Stress and Tolerance
- Drought Resistance
- Thatch Accumulation
- Cold Tolerance
- Wear Tolerance
- Recuperative Potential

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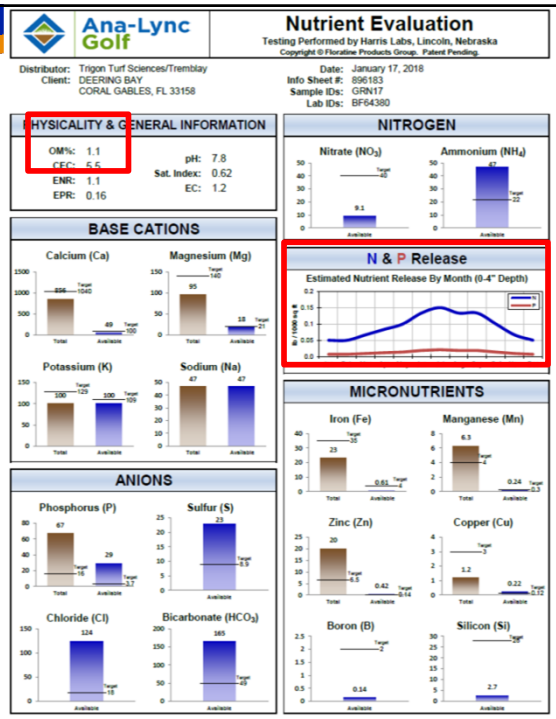

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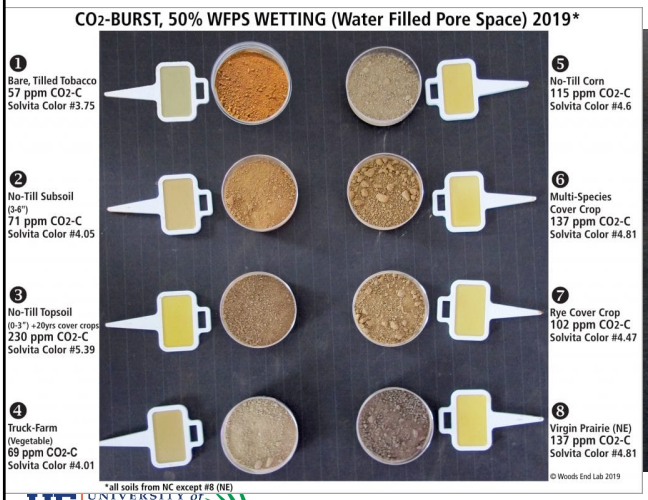
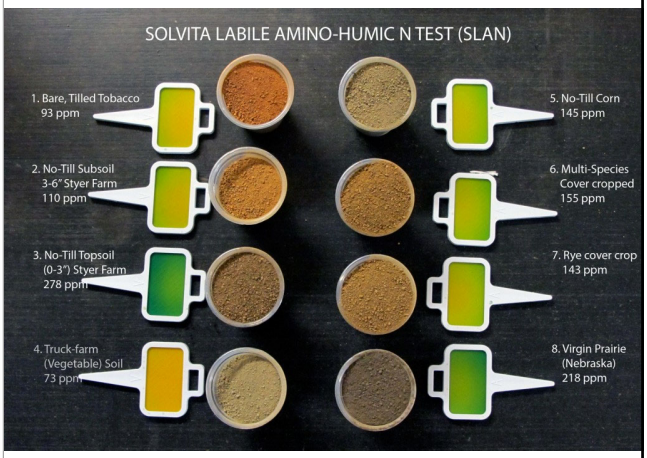
Solvita





https://solvita.com/

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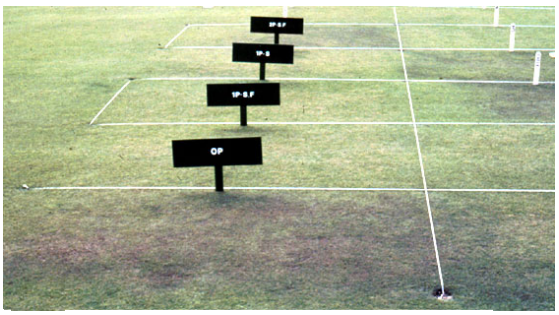
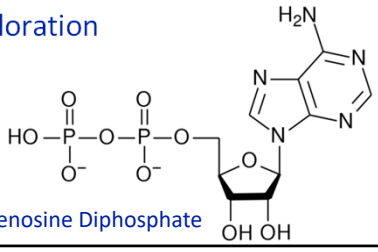
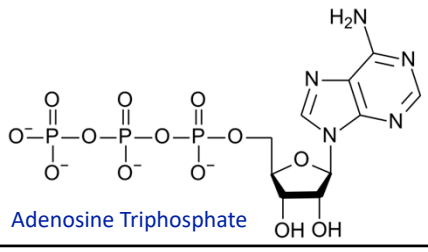
Phosphorus (P)

- Involved in nearly all metabolic processes especially those involving energy transfer
- Structural constituent in several biochemicals
- Deficiency symptoms
  - Initially dark green
  - Purple discoloration





Adenosine Diphosphate



Adenosine Triphosphate

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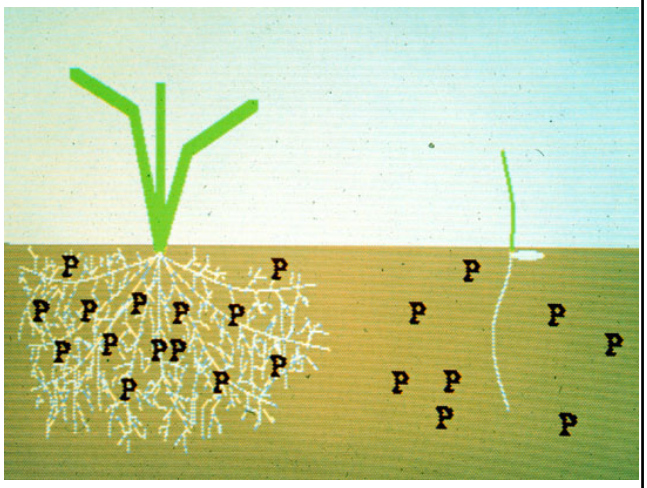
Turf Response to P

- If turf is initially deficient, one may observe:
  - Darker green
  - Enhanced root growth, especially on young turf
  - Enhanced cold tolerance, drought recovery and water use efficiency
- If turf is not deficient, one may observe:
  - Little to no response



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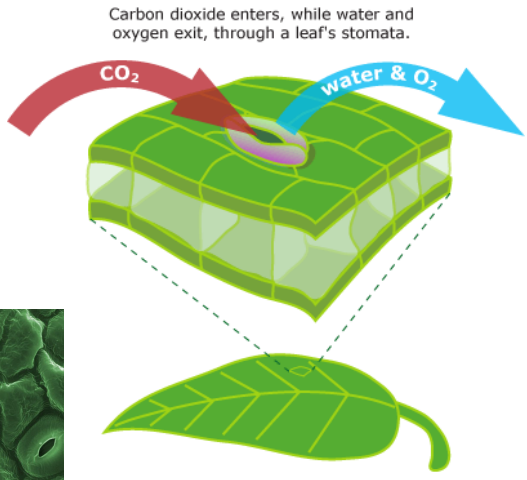
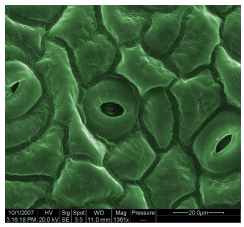
Potassium (K)

- Required for activation of many enzymes
- Osmoregulation – regulates guard cells -> water regulation in plants
- Used in carbohydrate, amino acid, and protein synthesis
- Stress tolerance





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Potassium (K) Nutrition

- Many ignore potassium fertilization because there is no obvious visual or growth response from applications
  - Deficiencies can lead to:
    - Increased wilting
    - Winter desiccation
    - Reduced drought tolerance
    - Reduced wear tolerance
    - Increased disease susceptibility

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Soil Analysis

- The tenets of proper soil testing include:
  - Sampling
  - Testing
  - Interpretation
  - Recommendations

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Soil Sampling Depth

- Probably the greatest source of error
- Proper sampling procedures involve ensuring that the soil sample accurately represents the area where the turf or landscape will be grown
  - Soil samples should be taken from the depth in which most of the roots exist – typically the upper 4” for turf and landscape soils

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Soil Sampling Depth

- Using a soil probe or garden spade, take 10 – 15 random samples from the areas in questions
- Avoid mixing soil from healthy areas with soil from unhealthy areas as this will reduce the ability to diagnose the problem
- Thoroughly mix the soil and place a in a soil sample bag

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Soil Analysis

- The tenets of proper soil testing include:
  - Sampling
  - Testing
  - Interpretation
  - Recommendations

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Soil Testing Procedures

- Soil testing procedures focus on extraction or digestion of the sample
  - The purpose of the extractant is to determine the quantity of an element that would be representative of, or correlates to, what will be available for plant uptake during that growing season
  - The method employed is specific to the nutrients, the geographic region, and the physiographic and mineralogical nature of the sampling site

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Photo Credit: https://agrilifeextension.tamu.edu/assets/environment-natural-resources/soil/soil-testing/

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Soil Extractants Differ

Region	Soil P Extractant	
Arid and semiarid Midwest, West, and Northwest	Olsen Am. Bicarbonate + DTPA	$NaHCO_3$ NH_4HCO_3 + DTPA
Humid Midwest, mid-Atlantic, Southeast, and eastern Canada	Mehlich 3 Bray 1	Acetic Acid + NH_4NO_3 + NH_4F + Nitric Acid + EDTA HCl and NH_4F
North central and Midwest	Bray 1	HCl and NH_4F
Washington and Oregon	Bray 1 for acidic soils Olsen for alkaline soils	HCl and NH_4F $NaHCO_3$
Southeast and mid-Atlantic	Mehlich 1 Mehlich 3	HCl + H_2SO_4 Acetic Acid + NH_4NO_3 + NH_4F + Nitric Acid + EDTA
Northeast (New York and parts of New England), some labs in Idaho and Washington	Morgan or modified Morgan Mehlich 3	Acetic Acid Acetic Acid + NH_4NO_3 + NH_4F + Nitric Acid + EDTA

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Soil Analysis

- The tenets of proper soil testing include:
  - Sampling
  - Testing
  - Interpretation
  - Recommendations

These two create considerable confusion and frustration!

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Crop: **St. Augustinegrass Lawn**

Report Date: 16-Dec-21

Soil Test Results and Their Interpretations

Target pH: 6.5 This is the pH at which the above crop will grow at its optimum

pH (1:2 Sample:Water): 7.8 This is the pH of your sample in water medium

A-E Buffer Value: N/A Buffer pH is the pH of your soil in Adams-Evans Buffer(A-E Buffer). This is done to determine the lime requirement, which will help increase the soil pH to the target pH level desired by the crop. If the pH is higher than Target pH, Buffer pH will not be determined

AB-DTPA Extractable Nutrients

Nutrients	Level mg/kg or ppm	Interpretation	Nutrients	Level mg/kg or ppm	
Phosphorus (P)	7	LOW	Sulfur (S)	2.4	*For these nutrients see directions on the following pages
Potassium (K)	8		Copper (Cu)	0.2	
Magnesium (Mg)	12		Manganese (Mn)	0.2	
			Zinc (Zn)	0.2	
Calcium (Ca)	66	Ca is typically adequate in Florida soils			

Lime and Fertilizer Recommendations

Crop: St. Augustinegrass Lawn

Lime:	0.00	lbs per 1000 sq. ft. per year
Nitrogen(N):	3.00	lbs per 1000 sq. ft. per year
Phosphorus(P_2O_5):	0.50	lbs per 1000 sq. ft. per year
Potassium(K_2O):	2.00	lbs per 1000 sq. ft. per year
Magnesium(Mg):	0.80	lbs per 1000 sq. ft. per year

We do not test soil for N as there is no meaningful soil test for predicting N availability. Thus, the N recommendation was developed from research that measured response of the indicated crop to applied N fertilizer. If you expect significant nutrient release from organic sources such as crop residues or organic amendments, estimate the amount mineralized and subtract that amount from the fertilizer recommendations given below to arrive at crop needs.

IMPORTANT: Prior to making any of the recommended applications, read carefully the footnotes/directions on this report. If you have any questions, please call the county extension agent listed above.

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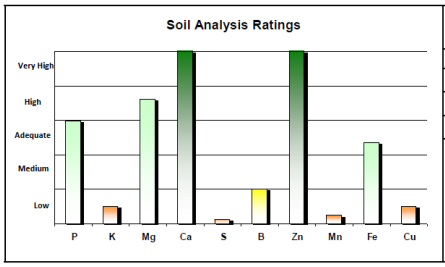
Test Method: Mehlich I — **Soil Laboratory Data (lbs/a)** — **Target pH 6.5**

P Phosphorus	K Potassium	Mg Magnesium	Ca Calcium	Soil pH	Buffer pH Adams-Evans	S Sulfur	B Boron	Zn Zinc	Mn Manganese	Fe Iron	Cu Copper
119 A	36 L	188 H	1318 VH	7.0	7.90	3 L	0.5 M	12.4 VH	5 L	16 A	0.4 L

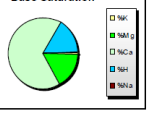
Al Aluminum	Na Sodium	NO3-N Nitrate-N	NH4 Ammonia	Soluble Salts	Organic Matter	ENR	Mo Molybdenum	Ni Nickel	BiCarbs
		ppm	ppm	mmhos/cm	%		ppm	ppm	meq/L



Cation Exchange Capacity 4.9 meq/100g

Base Saturation

K: 0.9 %	Mg: 15.9 %
Ca: 66.9 %	H: 16.2 %
Na: %	



Crop: COASTAL BERMUDA — **Fertility Recommendations (lbs/a)** — **Yield: GRAZING MAX**

Lime Tons/Acre	Gypsum Tons/Acre	N Nitrogen	P205 Phosphate	K20 Potash	Mg Magnesium	S Sulfur	B Boron	Zn Zinc	Mn Manganese	Fe Iron	Cu Copper
		250	50 *	205		32	0.5		10.0		0.60

* = Maintenance Recommendation

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What's in the bag?

- Numbers refer to percent nitrogen, phosphorus, and potassium in the bag

  N – P_2O_5 – K_2O
- Example: 6-2-0
  - 15% **N**
  - 0% **P_2O_5**
  - 15% **K_2O**
- Nutrient sources are also listed

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What Fertilizer Should I Use?

- Quick Release (Water Soluble) N Sources:
  - Commonly used by professional lawn care companies and on commercial turf
  - Very effective fertilizer
  - Provide quick green-up (days) and growth surge but response is short term (< 30 days)
  - Can leach if over-applied or followed by excess irrigation or rainfall
  - Less expensive

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Quick Release (Soluble) Nitrogen

- Inorganic Carriers:
  - Ammonium Nitrate
  - Ammonium Sulfate
  - Potassium Nitrate
- Organic Carriers:
  - Urea

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What Fertilizer Should I Use?

- Slow Release (Insoluble) N Sources:
  - Releases nitrogen slowly over time
  - Release rate tied to technology
  - Response may range from 30-180 days
  - Less growth surge and green-up after application
    - Sometimes homeowners get discouraged and re-apply when they don't see a response
  - More expensive
  - Products may be prone to runoff

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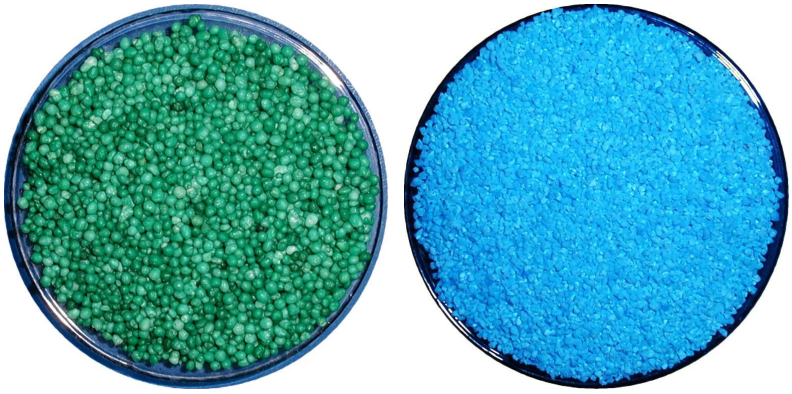
Slow Release (Insoluble) Nitrogen

- Methylene Urea
- Stabilized Nitrogen
- Coated Materials
  - Sulfur
  - Resin
  - Polymer
  - Plastic



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Natural Organic Fertilizer

Example Product	Analysis (N-P_2O_5-K_2O)	Trade Name (examples)
Fertilizer Sources		
Activated sewage sludge	6-4-0, 4-3-0	Milorganite®, e-Corganite™
Composted poultry manure	5-2-4, 5-4-5, 5-3-2	Sustane®, EarthWorks™ Replenish, Richlawn Organic
Iron sucrate	micronutrient	SuGrow® Granular
Meals and Extracts		
Hydrolyzed poultry feathers meal	10-0-6, 11-2-2, 10-2-8	Ringer Lawn Restore®, Scotts® Natural Lawn Food, Nature Safe® All Season Fertilizer
Corn gluten meal	8-2-4, 9-0-0	Gardens Alive!® WOW!® Supreme, Espoma® Organic Weed Preventer
Soybean meal	7-1-2, 10-0-2	The Andersons® innova®, PurelyOrganic™ - Plant Based Lawn Food
Bone meal	4-12-0	Espoma® Organic Bone Meal
Blood meal	12-0-0	Whitney Farms® Natural Blood Meal

N = Nitrogen, P = Phosphorus, K = Potassium, Fe = Iron

***Additional products are available in different formulations for all these products.**

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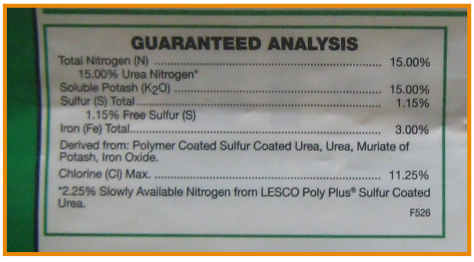
What Fertilizer Should I Use?

- Most retail products are a blend of QRN and SRN



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Nutrition and Fertilization BMPs

The goal of a proper nutrient management plan should be to apply the minimum necessary nutrients to achieve an acceptable quality and apply these nutrients in a manner that maximizes their plant uptake

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Practical Considerations

- Nutrients must be applied based on the plant's ability to assimilate them
- Healthy, dense turf is the key to minimizing environmental impact of applied nutrients
  - As the health of the plant deteriorates – one can expect problems
- Reclaimed water contains nutrients that should be factored into fertilizer needs
  - Check with reclaimed water provider to obtain nutrient levels

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Questions?
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10th anniversary
UF/IFAS
Turfgrass
Science
Program

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