

Plant Nutrition

Nutrients

Physiology

Soil

Nutrient  
Deficiencies

Fertilizers

Selecting

Forms of N

Reading the  
label

Applying

When

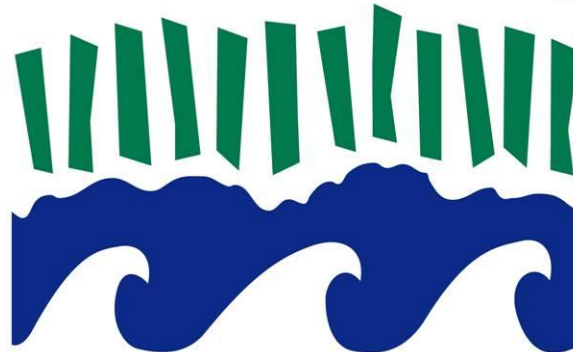
How much

How to

# Fertilize Appropriately

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## Florida Yards & Neighborhoods



UNIVERSITY OF  
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# Plant Nutrition

- Essential Nutrients- elements an organism must have for survival
  - Plants obtain most essential nutrients from minerals and organic matter in soil
  - Growth is limited by the element in shortest supply

In the following table, 18 elements are classified by the relative quantity needed by plants.

# Macronutrients

|          |   |
|----------|---|
| Carbon   | C |
| Hydrogen | H |
| Oxygen   | O |

|            |    |
|------------|----|
| Nitrogen   | N  |
| Phosphorus | P  |
| Potassium  | K  |
| Sulfur     | S  |
| Calcium    | Ca |
| Magnesium  | Mg |

- From air and water
- From soil and fertilizer

# Micronutrients

|            |    |
|------------|----|
| Iron       | Fe |
| Manganese  | Mn |
| Boron      | Bo |
| Copper     | Cu |
| Zinc       | Zn |
| Molybdenum | Mo |
| Chlorine   | Cl |
| Cobalt     | Co |
| Nickel     | Ni |

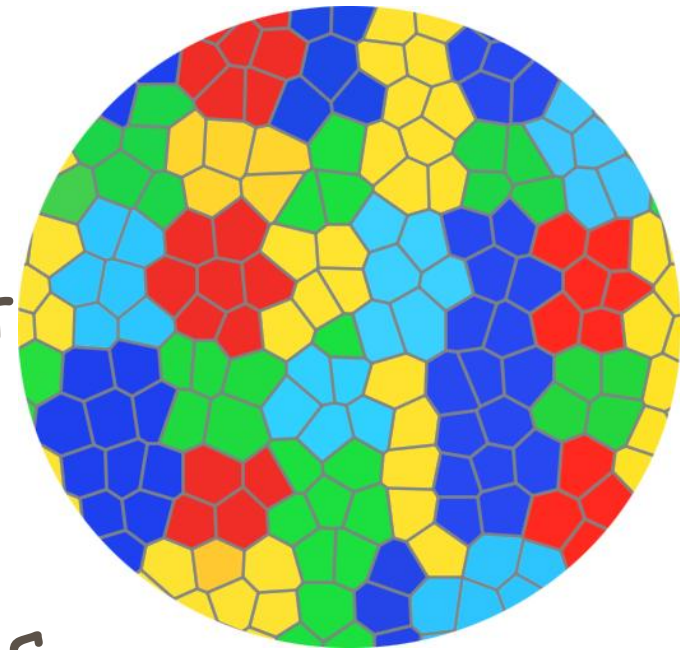


# Plant Roots...

- Respire- break down sugar for energy
- Need oxygen
- Absorb nutrients from the soil solution (thin water layer around soil particles)
  - They do not take up solid particles
  - Most minerals are only slightly soluble in water, so only a small portion is available to plants at any given time

# Soil- The interface of minerals, air, water, and life

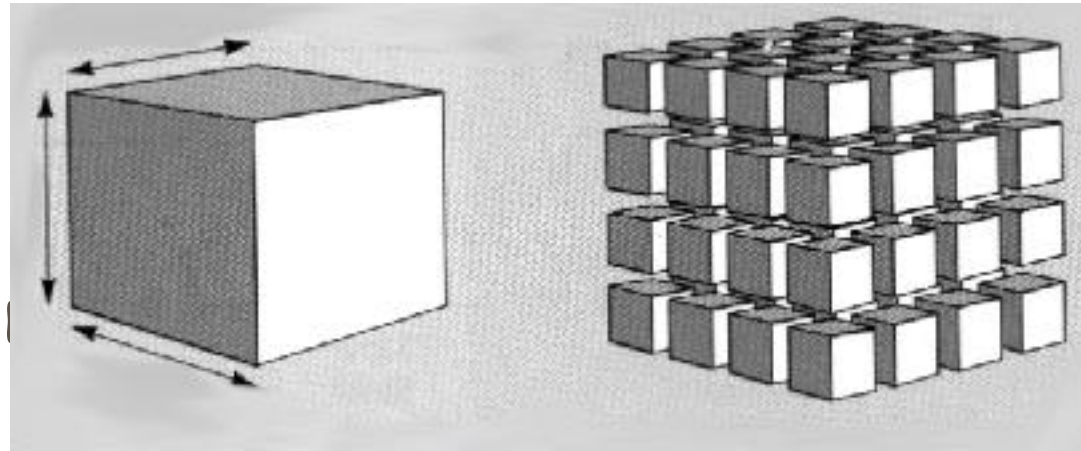
- Medium for plant growth
- Regulates gas exchange
- Controls water movement
- Filters water
- Recycles raw materials
- Habitat for soil organisms



# Soil Minerals

Texture- proportions of different sized mineral particles:

- Gravel  $>2$  mm
- Sand 0.05-2 mm
- Silt 0.002- 0.05 mm
- Clay  $<0.002$  mm



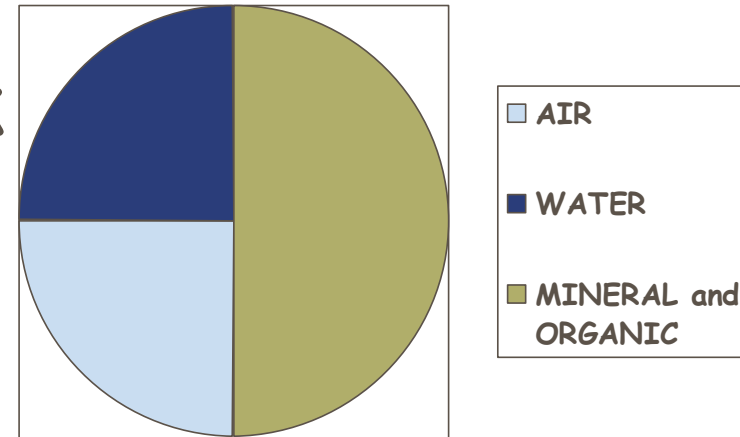
Sand

Clay

By volume, clays have more surface area than sand for nutrients to bind.

# Soil Air

- The spaces between soil particles form a network of soil pores that allow movement of:
  - Gases
  - Water
- Soil compaction
  - Restricts movement
  - Reduces plant growth



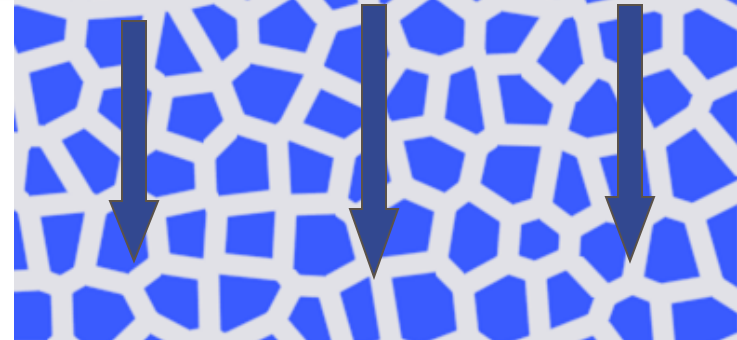
**Relatively equal proportions of air and water are ideal for plant growth.**

Nyle Brady and Ray Weil, [The Nature and Properties of Soils](#). 12th Edition

# Soil Water

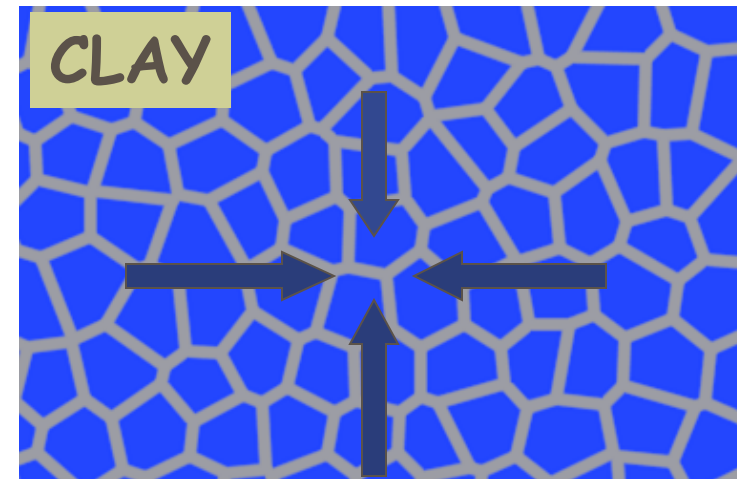
- Water is held in soil pores. The amount of water available to plants largely depends on:
  - Soil texture
  - Pore sizes

SAND



Larger pore spaces lose water first.

CLAY



Small spaces hold water more tightly.

The background of the slide is a light blue sky with several blue raindrops falling. Below the sky is a layer of brown, sandy soil represented by a dense field of small, rounded particles. A white rectangular box is centered over the soil, containing text. Another white rectangular box is positioned above the soil, containing the title.

# Florida's Sandy Soils

Rapid infiltration  
Poor water holding capacity  
Poor nutrient holding capacity  
Low in organic matter  
Prone to leaching

# Organic Matter

When preparing soil for planting, improve the nutrient and water holding capacity of a soil by adding...

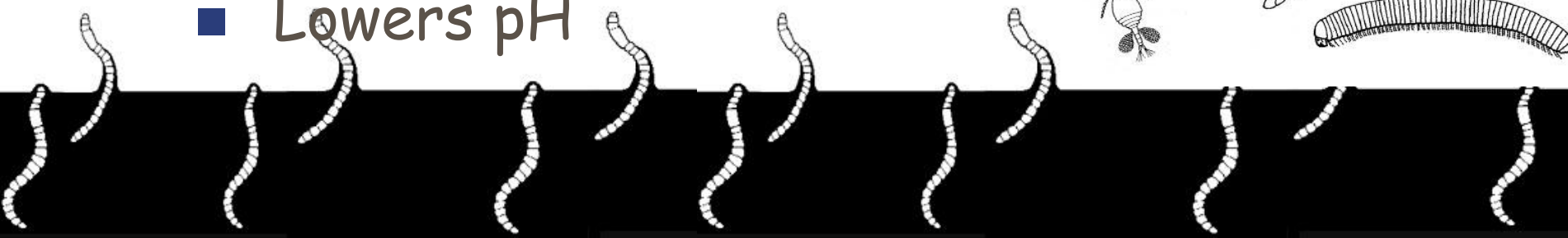
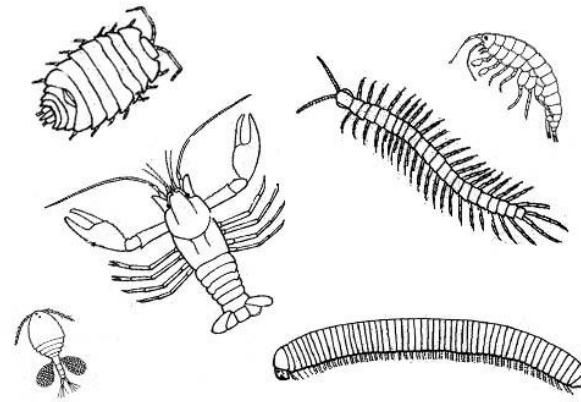
- Manure
- Earthworm castings
- Compost
- Mulch



**Combine natural organic materials with commercially produced fertilizers to maximize benefits while minimizing negative environmental impacts.**

# Soil Organisms

- In nature, plants grow without the addition of chemical fertilizers
- Earthworms, insects, nematodes, bacteria, and fungi help to decompose organic matter, which:
  - Slowly releases nutrients
  - Dissolves minerals
  - Lowers pH



# Why Apply Fertilizer?

- To obtain a desired result:

- Establish newly installed plants
- Promote root and shoot growth
- Enhance flowers and fruit set
- Correct or prevent nutrient deficiencies

**Rose with iron deficiency.**





# Nutrient Deficiency

- A nutrient is deficient if its absence prevents the plant from developing normally
- Manifest differently in monocots and dicots
- Plants exhibiting chronic deficiencies may not be suited for that site, consider replacing such plants with adapted species

**Learning to identify nutrient deficiencies commonly expressed by plants can help to determine which element is limiting growth...**

# Nitrogen Deficiency

## Typical Plant Responses:

- Uniform yellowing (chlorosis) of older foliage first. Leaf color fades to ivory with red hue
- Entire plant stunted
- Growth slows dramatically
- Common in containerized or recently transplanted plants
- Common in turf grown in sand

### **Solution:**

Apply nitrogen. Soluble and insoluble forms are available.



**Azalea**

# Potassium Deficiency

## Typical Plant Responses:

- Yellowing from margins toward center in older leaves first
- Orange spots
- Necrotic margins
- Leaves frizzled, midrib alive

**Solution:**

Apply potash, potassium chloride, or potassium sulfate.



Bauhinia

Palm

# Magnesium Deficiency

## Typical Plant Responses:

- Distinct yellow, inverted "V" pattern on older, mature leaves
- Necrotic spots
- Curled leaf margins



Holly



Date Palm

**Solution:**

**Apply magnesium sulfate or Epsom salts.**

# Iron Deficiency

## Typical Plant Responses:

- Interveinal chlorosis- young leaves turn yellow but veins remain green
- Common in alkaline, compacted, or poorly drained soils



Fishtail Palm



Bahiagrass

## Solution:

Apply iron sulfate or chelated iron.



Sweetgum

# Manganese Deficiency

## ■ Typical Plant Responses:

- Interveinal chlorosis-  
young leaves yellow  
with wide green veins
- Contortion
- Death of palm bud
- Common on  
alkaline soils
- Common in palms



Queen Palm



Sago Palm



Gardenia

# Zinc Deficiency

- Typical Plant Responses:
  - Young leaves abnormally small and narrow
  - Internodes short
  - Wavy or puckered margins
  - Common on alkaline soils



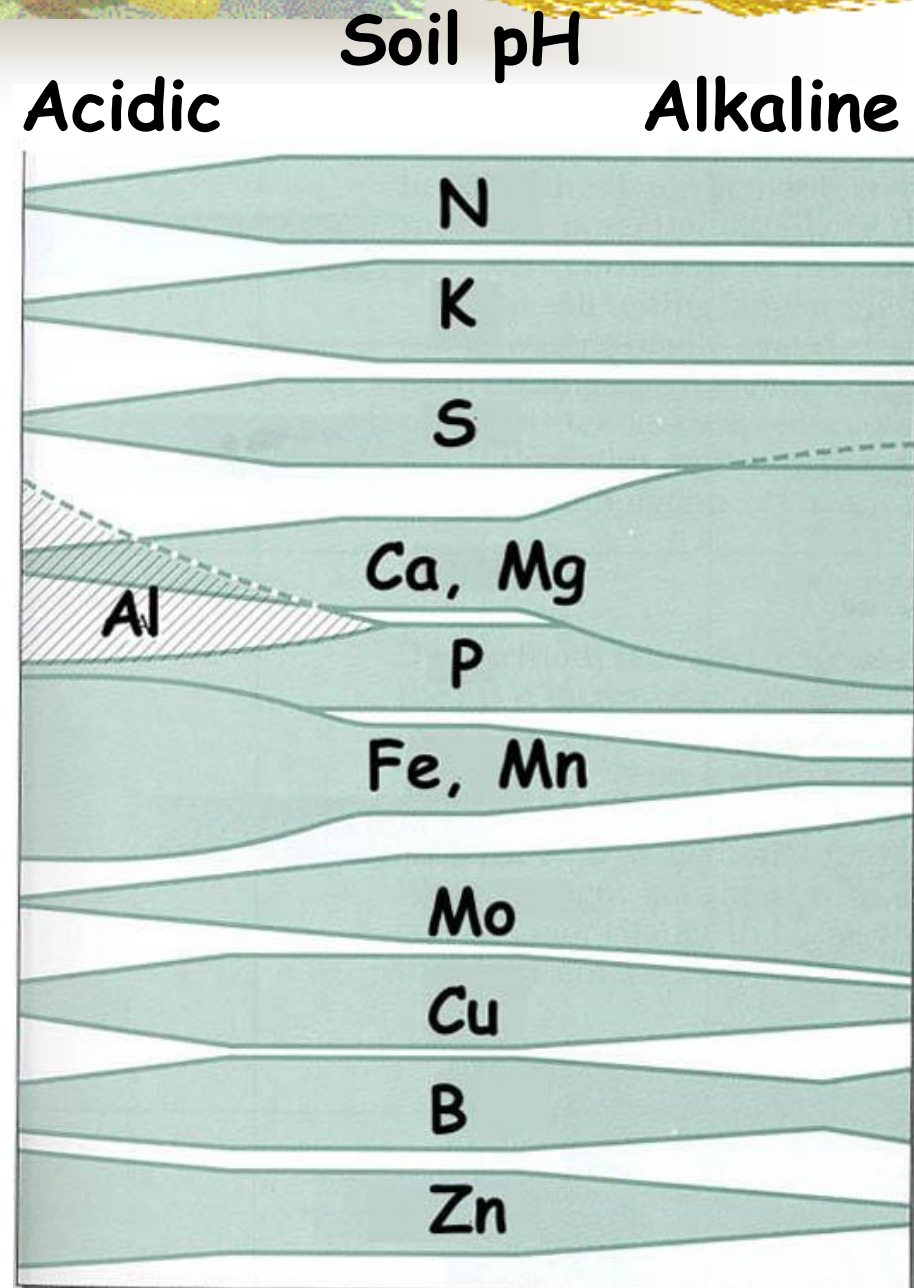
Dogwood



Peach

# Soil pH

- Degree of soil acidity or alkalinity
  - Affects nutrient availability
  - Affects plant performance





# Suitable Plants

- Adjusting pH is a temporary solution- better to put the right plant in the right place
- If plants exhibit nutrient deficiency symptoms because they are not suited to the site conditions, consider replacing.
  - Prefer acidic soils- Bahiagrass, Azalea, Holly, Blueberry, and Ixora
  - Prefer alkaline soils- Elm, Red Cedar, Sycamore, and Yucca

Azaleas planted near the foundation of a home are growing poorly, the leaves are yellow with green veins. What is going on?

Azaleas prefer acid soils. The concrete construction materials of the home have raised the pH of the soil, resulting in an Fe deficiency and poor growth overall.



**Solution: Replace plant with adapted species.**

# When to Apply

- When applying fertilizer is likely to give you the desired response
  - Add only those nutrients needed
  - Apply micronutrients at specified rates and times to achieve fertilization objectives
- When nutrients are limiting growth
  - Observations
  - Soil test
  - Leaf tissue samples

**Boron deficiency in Philodendron**





# When Do I Apply Nitrogen & Potassium to Lawns & Landscape Plants?

- During the active growing season
  - In spring, after danger of frost
  - In early fall, before winter dormancy
  - Year-round in South Florida
  - Apply iron to green up lawn in summer
- During establishment
- During recovery
  - From drought, wear, insects, or disease



# Selecting a Fertilizer

- Buy fertilizer that contains only the nutrients you need
  - Test soil to determine what nutrients are needed
- If applying N, you need to consider what source to use
  - Water Soluble- rapidly released to plants
  - Water Insoluble- slowly released

# Water Soluble Nitrogen

- Rapidly released to plants

- Nitrate
- Ammonium nitrate & ammonium sulfate
- Urea

Available  
in liquid  
& granular  
form



Fertilizer burn

- The potential for leaching and burning is greater due to misapplication

- Apply no more than  $\frac{1}{2}$  lb. N/ 1000 ft<sup>2</sup>
- Irrigate fertilizer in with  $\frac{1}{4}$ " of water
- Postpone fertilization if rainfall is expected
  - Too much water can move the nutrients past the root zone, where they can leach into groundwater



# Water Insoluble Nitrogen

- Slowly released to plants
  - Organic N
  - IBDU
  - Urea-formaldehyde, Ureaform, or nitroform
  - Coated ureas
    - Sulfur, plastic, polymer, or resin-coated
    - Release rates controlled by coating thickness, environmental conditions and diffusion rates
- Useful in hot, rainy weather
- Drop-type spreaders can damage coating



# Florida Fertilizer Label

- Florida law requires companies to print the precise nutrient content
- Read the label carefully to determine:
  - "Guaranteed Analysis" - minimum percentage of nutrients claimed by the manufacturer
  - "Derived From" - materials from which the fertilizer is made



# Guaranteed Analysis

16 - 2 - 8

nitrogen - phosphorous - potassium

- Indicates the bag contains, by weight:
  - Total nitrogen (N).....16%
  - Available phosphate ( $P_2O_5$ )..... 2%
  - Soluble potash ( $K_2O$ ).....8%

Historically, fertilizers that contain N-P-K are known as “complete fertilizers.” How is this term misleading consumers?



# Don't Be Fooled

- The term "complete fertilizer" implies that N, P & K are all a plant needs
  - Many palms require additional Mg
- Many Florida soils are naturally high in P
  - A soil test can help determine if P is needed
  - Apply no more than 2% P, unless tests indicate the soil is low in phosphorus

Applying fertilizer when no plant response is desired, or when no response is obtained is wasteful and may contribute to water, soil and air pollution.

# Palms

- Prone to micronutrient deficiencies
- When using a soluble fertilizer: choose a ratio of 4-1-6-2
  - Example: 8-2-12-4
- Choose equivalent percentages of nitrogen, potassium and magnesium in controlled release form
- Palm fertilizer should also contain 1-2% iron and manganese, plus trace amounts of zinc, copper, and boron



Mg



# How Much Is Needed?

- Fertility needs vary due to:
  - Homeowner preference for low, medium, or high maintenance lawn or landscape
  - Species, season, and location within the state
- “Spoon Feed” - to avoid over fertilization, apply small amounts of nitrogen more frequently to turfgrass
  - Apply no more than  $\frac{1}{2}$  lb. N/ 1000 ft<sup>2</sup> soluble N
- Choose fertilizers with 30% or more of the nitrogen in slow release form
  - Up to 1 lb. N/ 1000 ft<sup>2</sup> slow-release N

# Calculating Rates of N

Most fertilizer calculations are based on lbs. N/1000 sq ft.

■ For example, To apply 1 lb N:

- Divide 100 by percent N
- $100/16 = 6.25$  lbs of fertilizer
- This means 6.25 lbs of this fertilizer contains 1 lb actual N
- Calibrate your fertilizer spreader to apply 6 lb fertilizer/ 1000 sq ft
- Remember- if you are using soluble N apply half this amount!



# How to Apply Fertilizer

- Measure the square foot area to be fertilized
  - Length x width
- Calibrate fertilizer spreader
- Broadcast uniformly over root zone
  - Trees and shrubs that overlap with lawn should receive one, not two, fertilizations
  - Spikes, plugs, liquid injections, and piles of fertilizer near a trunk are wasteful and may burn plant roots





# Reduce Stormwater Runoff

- Even if fertilizer is applied at proper rates, too much water following fertilization can result in leaching or runoff
- Use a fertilizer deflector shield when fertilizing near water bodies
  - Do not apply fertilizer within 3 ft of waters edge (with shield) or 10 ft from waters edge without shield
- Be careful not to apply fertilizer onto sidewalks or other impervious surfaces
- Sweep up fertilizer spills



# Further Reading

<http://edis.ifas.ufl.edu>

- ENH 858 "Fertilizer Recommendations for Landscape Plants"
- ENH 860 "Fertilization and Irrigation Needs for Florida Lawns and Landscapes"
- SL-20 General Recommendations for Fertilization of Turfgrasses on Florida Soils
- SL-3 "The Florida Fertilizer Label"
- SL-113 "Soil pH and Landscape Plants"
- SL-60 Plant Nutrients and Fertilizers for the Non-Farmer
- Visit: <http://turf.ufl.edu>



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