FLORIDA MASTER GARDENER

Fertilizer Know-how

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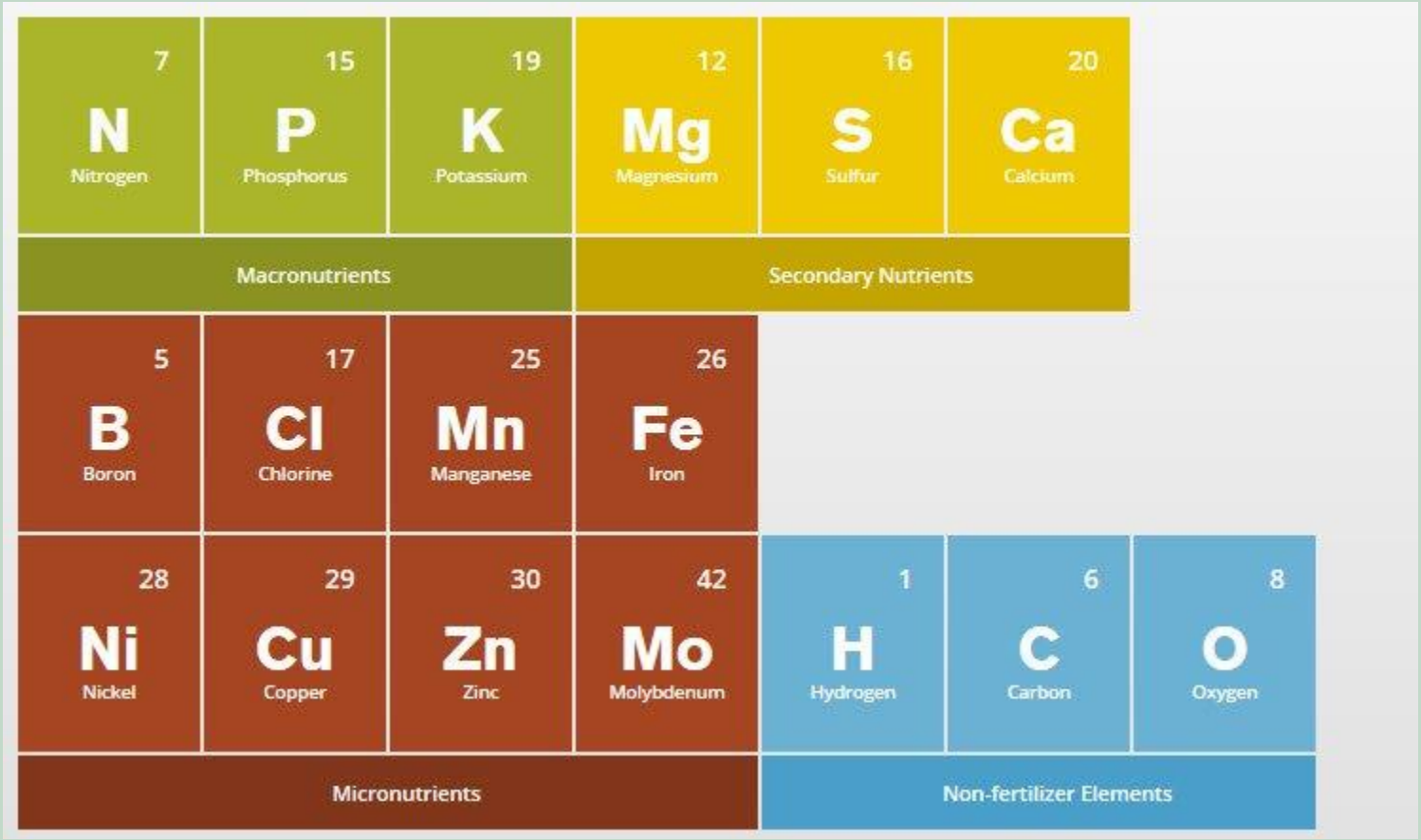
Plant Nutrition & Fertilizers

Learning Objectives:

- Know the 17 essential plant nutrients.
- Recognize common nutrient deficiency symptoms.
- Define common fertilizer terms:
  - Grade (aka Analysis)
  - Ratio
  - Complete
  - Inorganic (synthetic) vs Natural Organic Fertilizers
  - Water soluble vs controlled-release

17 nutrients are essential for plant health. If just one nutrient is lacking in the soil the plant will suffer.



17 Essential Nutrients

Supplied by Air and Water:

Carbon (C), Hydrogen (H), and Oxygen (O_2)

Usually Supplied by the Soil:

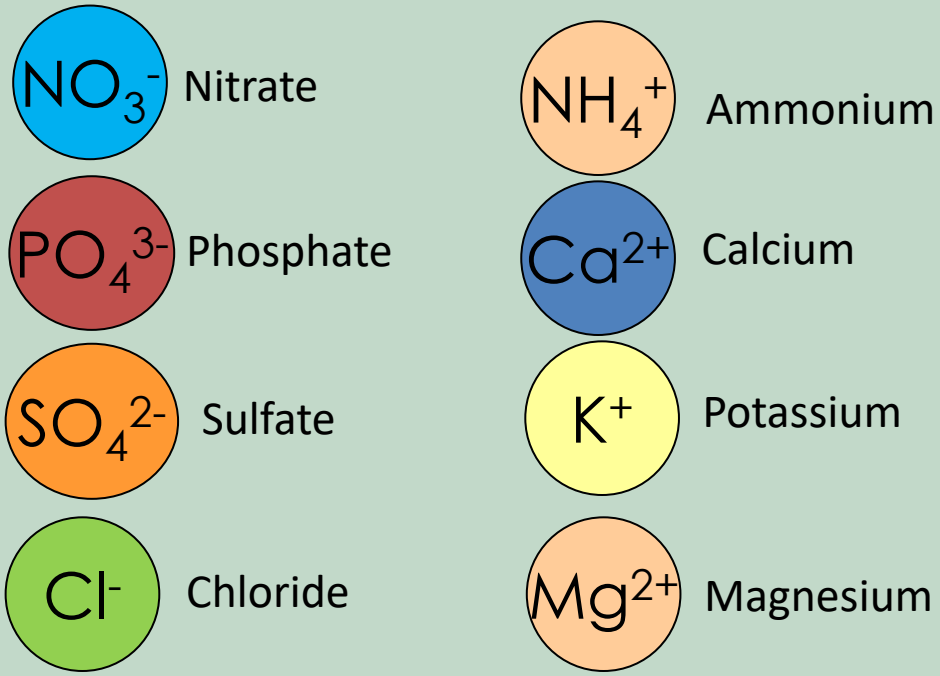
Macronutrients

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

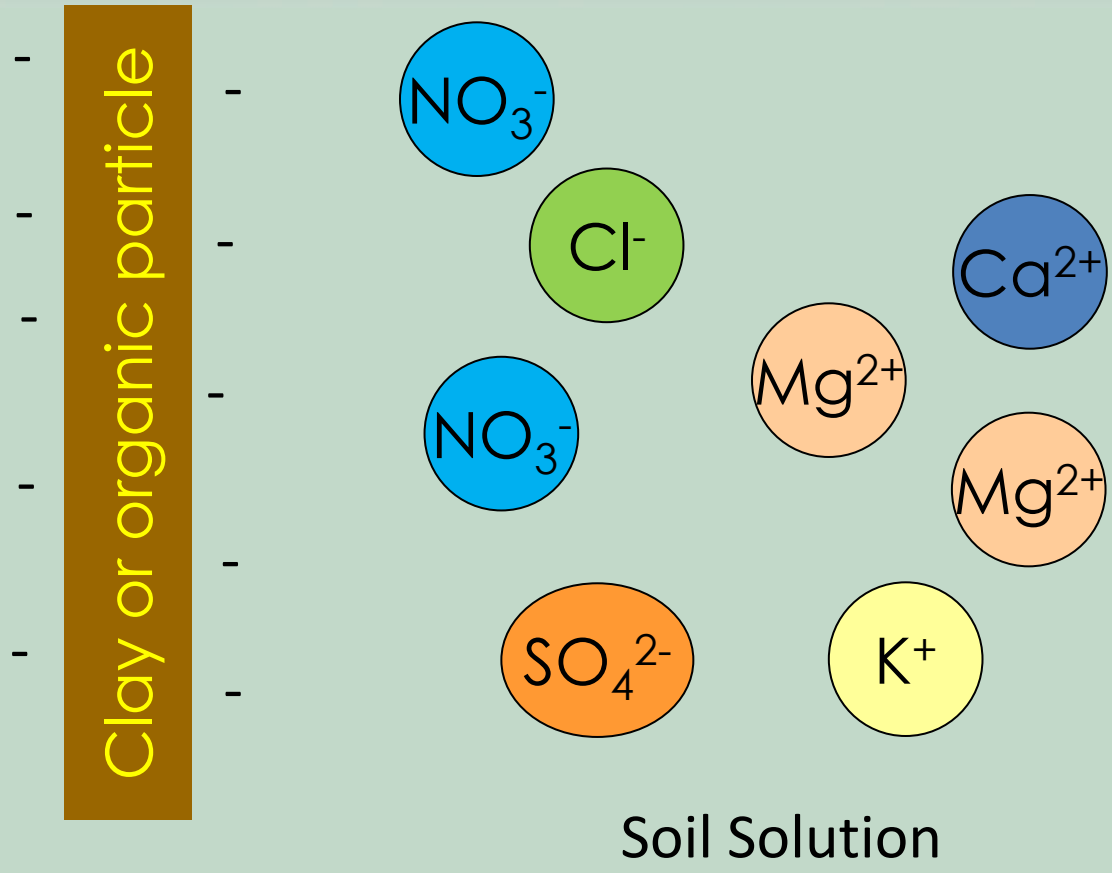
Micronutrients

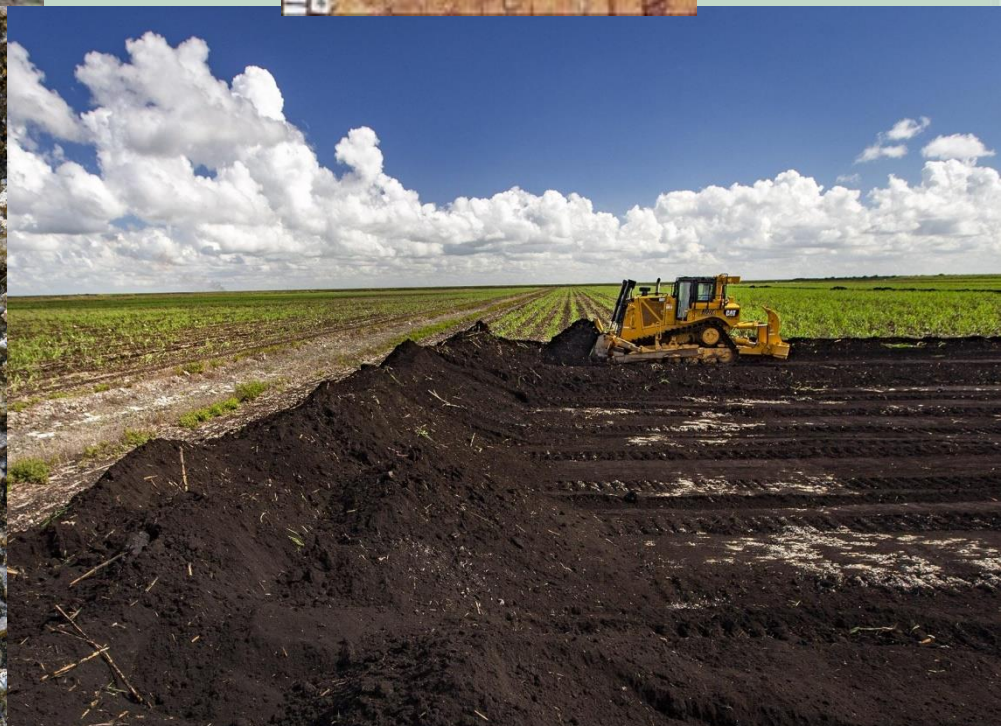
- Iron (Fe)
- Manganese (Mn)
- Zinc (Zn)
- Copper (Cu)
- Boron (B)
- Molybdenum (Mo)
- Chlorine (Cl)
- Nickel (Ni)

Plant nutrients – Cations and Anions



Soil Nutrient Holding Capacity





PO_4^{3-} Phosphate

- The predominant form of phosphorus taken up by plants.
- Does not readily leach from FL soil.
- Moves with *soil particles* – as when erosion occurs.
- Test soil every few years to determine if phosphorus is needed.

Why Fertilize?

- Achieve desirable plant response
  - Growth
  - More fruits / flowers
- Prevent/correct nutrient deficiencies

Credit: Brent Harbaugh, UF/IFAS

Diagnosing a Nutrient Deficiency

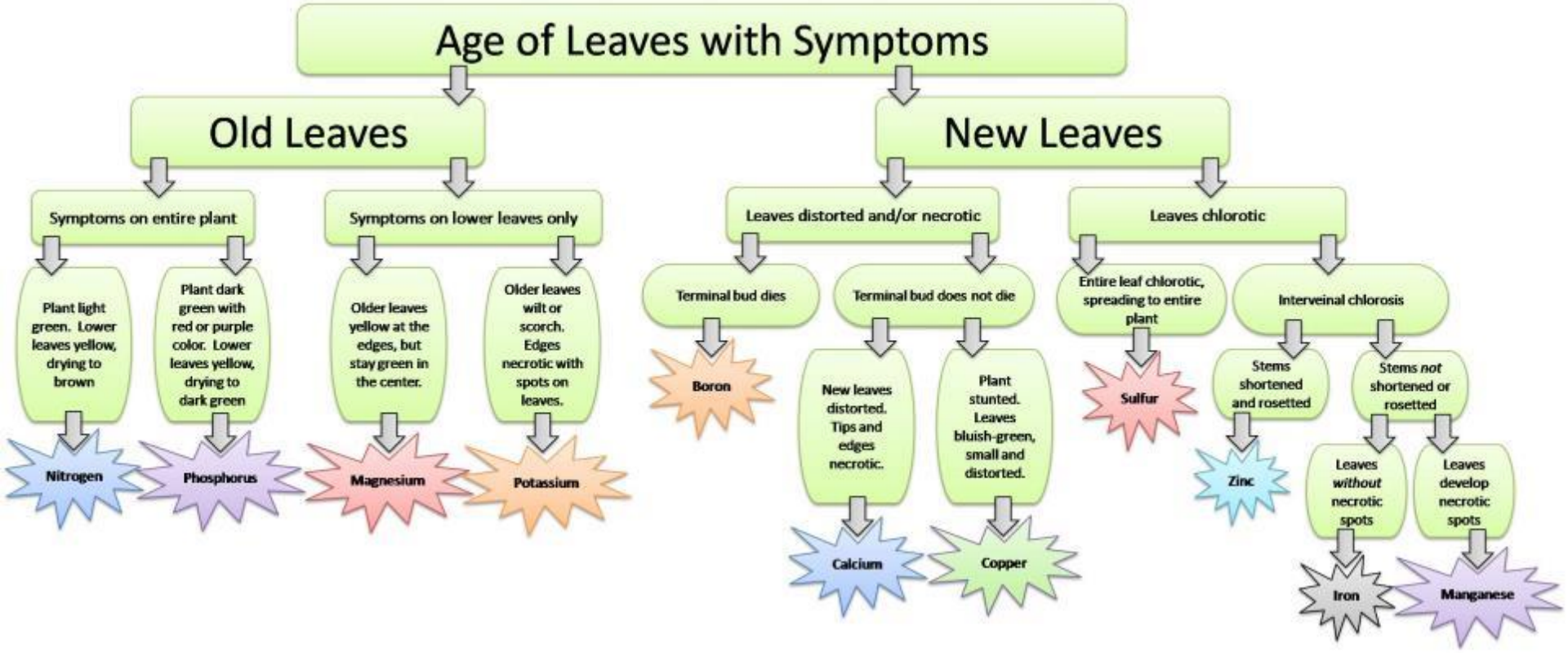


Figure Credit: Geoff Denny, UF-IFAS

See also: NutDef – Online nutrient key
http://hort.ufl.edu/database/nutdef/index_decision.shtml

Common Nutrient Deficiency Symptoms in Florida

Nitrogen

Potassium

Magnesium

Manganese

Iron

Photo Credits: UF-IFAS NUTDEF website; Brent Harbaugh, UF-IFAS (P only)

Magnesium

Manganese
‘frizzle top’

Iron

Calcium
‘blossom end rot’

Lawn and Landscape Fertilizers

Fertilizer Terms

- **Blend**: Several nutrient sources mixed together to create a fertilizer for a specific purpose.
- **Grade:** the % by weight of N, P_2O_5, & K_2O
  Example: 16-4-8 = 16% N, 4% P_2O_5, 8% K_2O
- **Ratio:** the relationship among the grade
  Example: 16-4-8 fertilizer has a ratio of 4-1-2
- **Complete fertilizer:** contains N, P & K

Test Yourself

- What is the grade of this fertilizer?
- How many pounds of nutrients does it contain?
- What is the fertilizer ratio?

The Florida Fertilizer Label

Guaranteed analysis

- Total N (%) broken down into:
  - Nitrate N
  - Ammoniacal N
  - Other/Water Soluble N
  - Urea N
  - Water insoluble N
- Available Phosphate (P_2O_5)
- Soluble Potash (K_2O)
- Chlorine (Cl) not more than…
- Statement of secondary plant nutrients (if any)
- "Derived from" statement
- Manufacturer/registrant info
- Net Weight

Brand Name
X-X-X (Grade)
Guaranteed Analysis

Total N…… ____%
_____% Nitrate N
_____% Ammoniacal N
_____% Other/Water soluble N
_____% Urea N
_____% Water Insoluble N
Available Phosphate (P_2O_5)……____%
Soluble Potash (K_2O)……____%
Chlorine, (Cl) Not More Than…____%
Secondary Nutrients (if any by %)
Derived from:
Manufactured by: Name, City, State, Zip
Net Weight - _____lb

See: *The Florida Fertilizer Label*/EDIS SL-3

Fertilizer Terms

- Inorganic or Synthetic fertilizers: Mined or synthesized from non-living (inorganic) materials
  Examples:
  - ammonium nitrate
  - ammonium phosphate
  - potassium chloride
- Natural Organic fertilizers: Derived from the remains or by-products of living organisms
  Examples:
  - Fish Meal
  - Bone Meal
  - Manure
  - Compost

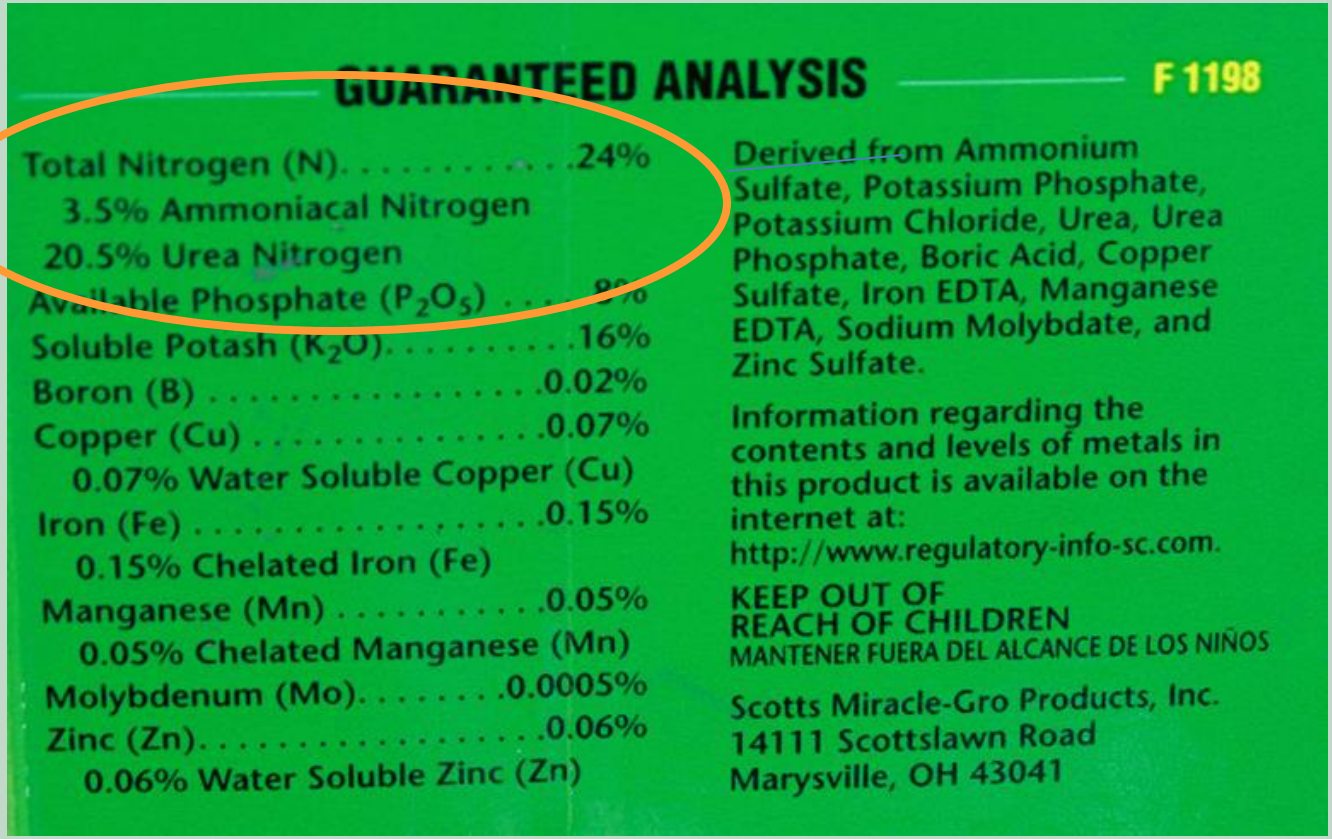
Fertilizer Types

- Water soluble fertilizer (Quick-release): Nutrients readily dissolve in water; immediately available for uptake by plant roots. (ammonium phosphate, KCl, magnesium sulfate, urea, Miracle-Gro, etc.)

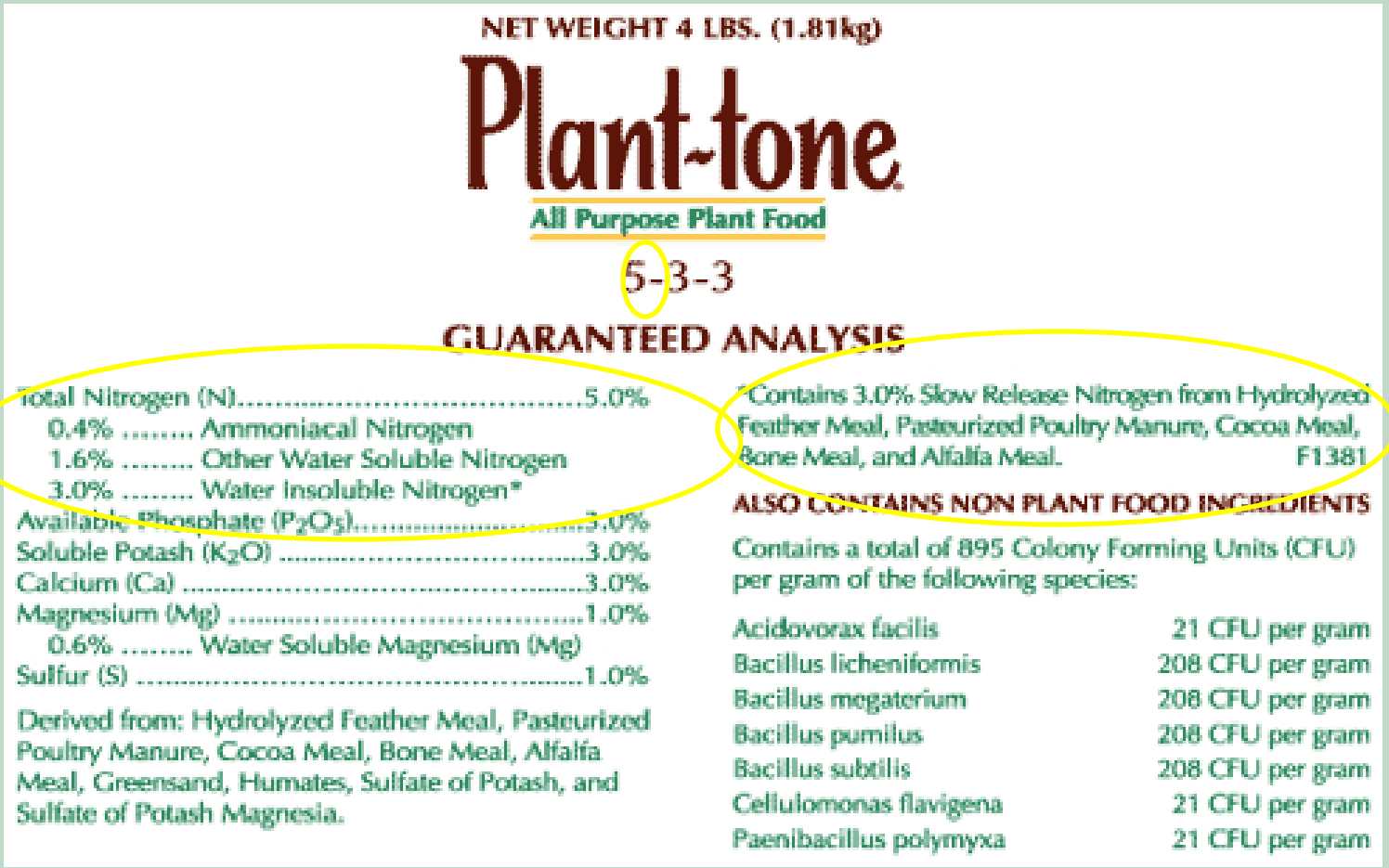
- Slow-release fertilizer: Synthetic or organic materials that gradually become soluble. Derived from:
  - natural, organic sources (manure, compost, fish emulsion, blood meal, etc.)
  - synthetic sources (IBDU, UF, etc.)

- Controlled-release fertilizer: Coated or encapsulated materials modified to release nutrients at a specific rate and duration. (Osmocote, Nutricote, etc.)

Quick-release N Fertilizer



Slow-release Organic-N Fertilizer



NET WEIGHT 4 LBS. (1.81kg)

Plant-tone

All Purpose Plant Food

5-3-3

GUARANTEED ANALYSIS

Total Nitrogen (N)	5.0%
0.4% ..... Ammoniacal Nitrogen	
1.6% ..... Other Water Soluble Nitrogen	
3.0% ..... Water Insoluble Nitrogen*	
Available Phosphate (P_2O_5)	3.0%
Soluble Potash (K_2O)	3.0%
Calcium (Ca)	3.0%
Magnesium (Mg)	1.0%
0.6% ..... Water Soluble Magnesium (Mg)	
Sulfur (S)	1.0%

Derived from: Hydrolyzed Feather Meal, Pasteurized Poultry Manure, Cocoa Meal, Bone Meal, Alfalfa Meal, Greensand, Humates, Sulfate of Potash, and Sulfate of Potash Magnesia.

*Contains 3.0% Slow Release Nitrogen from Hydrolyzed Feather Meal, Pasteurized Poultry Manure, Cocoa Meal, Bone Meal, and Alfalfa Meal. F1381

ALSO CONTAINS NON PLANT FOOD INGREDIENTS

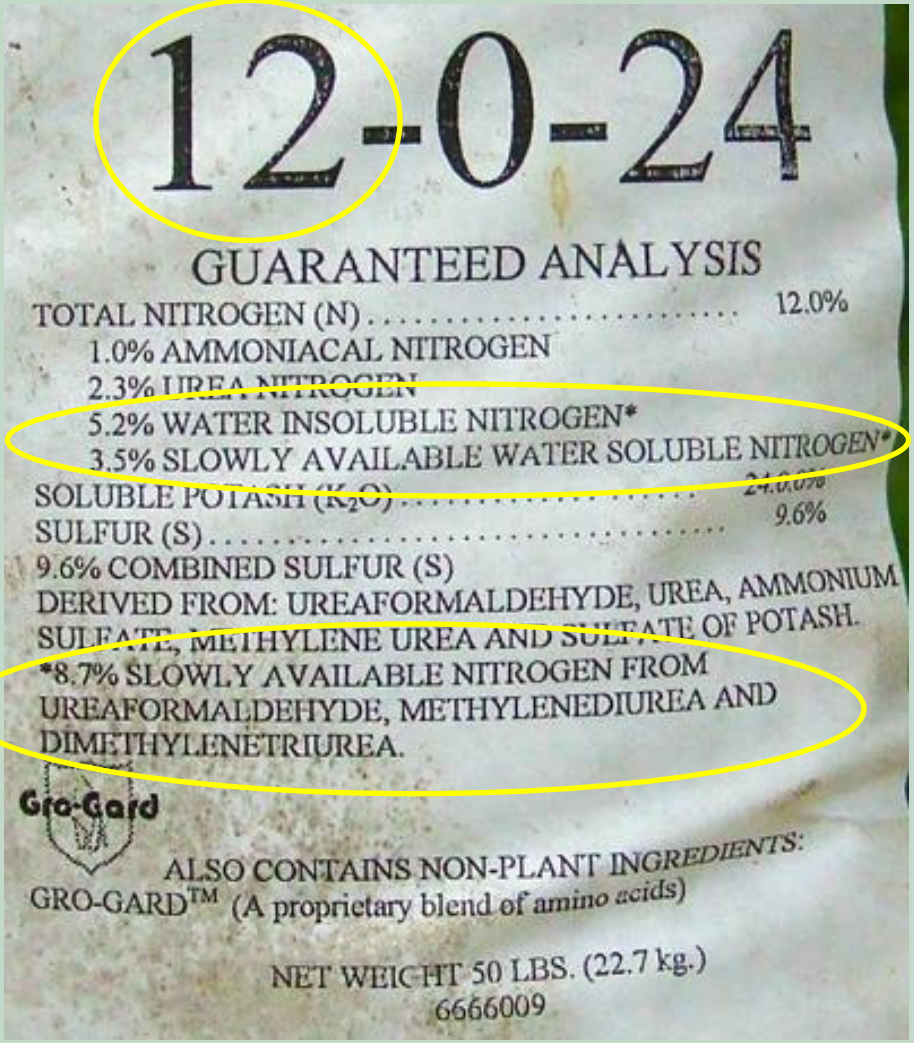
Contains a total of 895 Colony Forming Units (CFU) per gram of the following species:

Acidovorax facilis	21 CFU per gram
Bacillus licheniformis	208 CFU per gram
Bacillus megaterium	208 CFU per gram
Bacillus pumilus	208 CFU per gram
Bacillus subtilis	208 CFU per gram
Cellulomonas flavigena	21 CFU per gram
Paenibacillus polymyxa	21 CFU per gram

Slow-release Synthetic-N Fertilizer

Examples:

- Urea-formaldehyde
- IBDU



Synthetic/Controlled-release Fertilizer

Examples:

- Sulfur-coated urea
- Polymer-coated urea

Osmocote® Smart-Release® Plant Food Plus Multi-Purpose Plant Food

15-9-12 **GUARANTEED ANALYSIS** F1143

Total Nitrogen (N)†	15%
8.0% Ammoniacal Nitrogen	
7.0% Nitrate Nitrogen	
Available Phosphate (P_2O_5)†	9%
Soluble Potash (K_2O)†	12%
Calcium (Ca)†	1.9%
Magnesium (Mg) (Total)†	1.4%
0.7% Water Soluble Magnesium (Mg)	
Sulfur (S) (Total)†	4.0%
4.0% Combined Sulfur (S)	
Boron (B)†	0.02%
Copper (Cu) (Total)	0.05%
0.05% Water Soluble Copper (Cu)	
Iron (Fe) (Total)†	0.45%
0.42% Water Soluble Iron (Fe)	
0.03% Chelated Iron (Fe)	
Manganese (Mn) (Total)†	0.06%
0.06% Water Soluble Manganese (Mn)	
Molybdenum (Mo)†	0.02%
Zinc (Zn) (Total)	0.05%
0.019% Water Soluble Zinc (Zn)†	

†The Nitrogen, Phosphate, Potash, Calcium, Magnesium, Sulfur, Boron, Iron, Manganese, Molybdenum, and Zinc sources have been coated to provide 12.7% coated slow-release Nitrogen (N), 7.6% coated slow-release Available Phosphate (P_2O_5), 10.2% coated slow-release Soluble Potash (K_2O), 1.6% coated slow-release Calcium (Ca), 0.6% coated slow-release Magnesium (Mg), 3.4% coated slow-release Sulfur (S), 0.017% coated slow-release Boron (B), 0.38% coated slow-release Iron (Fe), 0.051% coated slow-release Manganese (Mn), 0.017% coated slow-release Molybdenum (Mo), 0.019% coated slow-release Zinc (Zn).

Scotts-Sierra Horticultural Products Company
14111 Scottslawn Road
Marysville, OH 43041

Information regarding the contents and levels of metals in this product is available on the Internet at www.regulatory-info-sc.com

Derived from: Polymer-Coated: Ammonium Nitrate, Ammonium Phosphate, Ammonium Sulfate, Calcium Phosphate, Potassium Sulfate, Potassium Nitrate, Potassium Chloride, Magnesium Oxide, Magnesium Sulfate, Calcium Carbonate, Ferrous Sulfate, Iron EDTA, Manganese Sulfate, Zinc Sulfate, Boric Acid, Sodium Molybdate; Copper Sulfate and Zinc Oxide.

Synthetic/Controlled-release Fertilizers

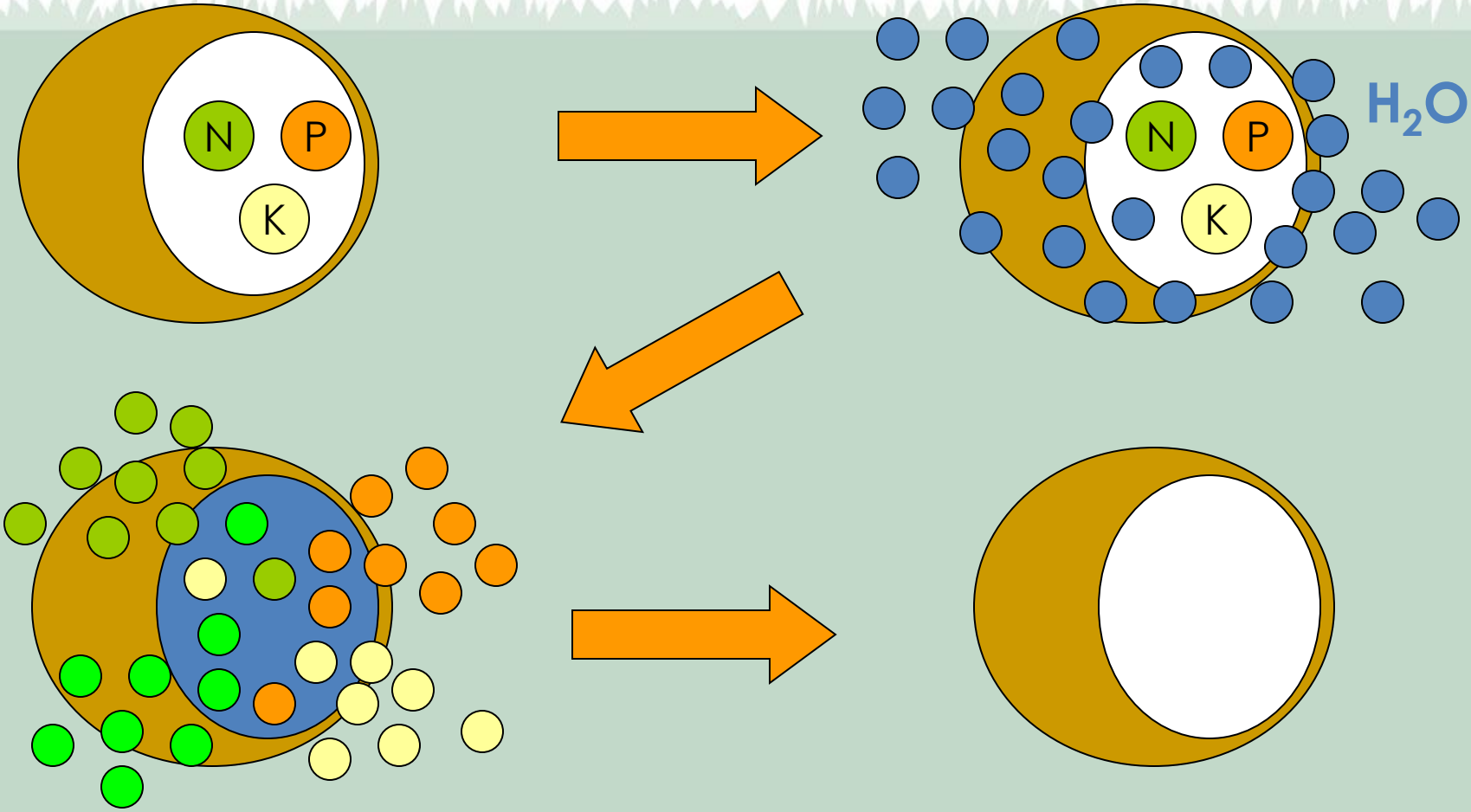
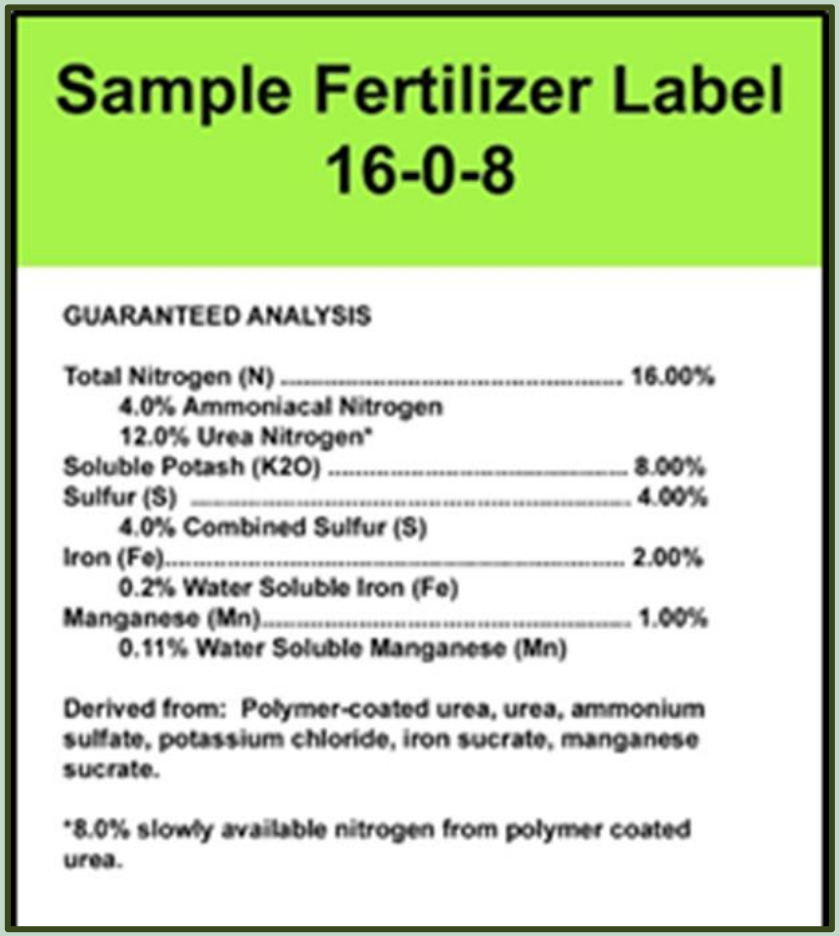


Figure Credit: Amy Shober

Fertilizer Label – Review!



Sample Fertilizer Label
16-0-8

GUARANTEED ANALYSIS

Total Nitrogen (N) 16.00%
4.0% Ammoniacal Nitrogen
12.0% Urea Nitrogen*
Soluble Potash (K_2O) 8.00%
Sulfur (S) 4.00%
4.0% Combined Sulfur (S)
Iron (Fe) 2.00%
0.2% Water Soluble Iron (Fe)
Manganese (Mn) 1.00%
0.11% Water Soluble Manganese (Mn)

Derived from: Polymer-coated urea, urea, ammonium sulfate, potassium chloride, iron sucrate, manganese sucrate.

*8.0% slowly available nitrogen from polymer coated urea.

Grade?
Ratio?
Complete?

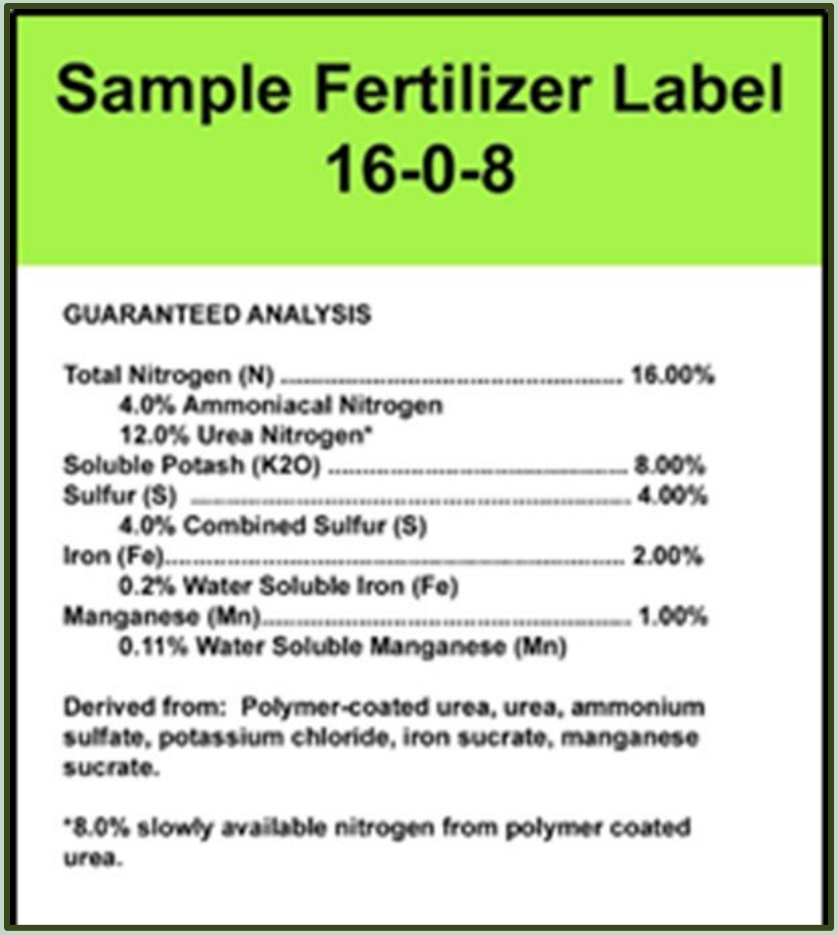
Percent slowly available N?

Source of slowly available N?

Sources of water-soluble N?

Secondary nutrients?

Fertilizer Label – Review!



Sample Fertilizer Label
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GUARANTEED ANALYSIS

Total Nitrogen (N) 16.00%
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Soluble Potash (K_2O) 8.00%
Sulfur (S) 4.00%
4.0% Combined Sulfur (S)
Iron (Fe) 2.00%
0.2% Water Soluble Iron (Fe)
Manganese (Mn) 1.00%
0.11% Water Soluble Manganese (Mn)

Derived from: Polymer-coated urea, urea, ammonium sulfate, potassium chloride, iron sucrate, manganese sucrate.

*8.0% slowly available nitrogen from polymer coated urea.

Grade: 16-0-8
Ratio: 2-0-1
Complete? No, 0% P

Percent slowly available N: 50% (8% of the total 16%N)

Source of slowly available N: Polymer-coated urea

Sources of water-soluble N: urea and ammonium sulfate

Secondary nutrients: sulfur, iron, manganese

The Bottom Line – Do's

Do:

- Read the fertilizer tag before purchasing a product.
- Follow UF/IFAS recommendations.
- Fertilize "as needed" according to the age (self-sufficiency) of plants.
- Be mindful of the pest, maintenance, and environmental problems caused by excess nitrogen and phosphorus.
- Use fertilizers containing slow- or controlled-release N and low P.
- Use compost and organic mulch to increase the nutrient holding ability of soil.
- Keep fertilizer off of hard surfaces.

The Bottom Line

Don’t:

- Don’t fertilize established trees and shrubs surrounded by fertilized lawn.
- Don’t try to correct a deficiency with a complete fertilizer - just apply the missing nutrient(s).
- Don’t use combination products e.g., “weed and feed.”
- Don’t “deep root feed” (inject fertilizers) except on slopes where it could run off.
- Don’t apply fertilizer when heavy rain is predicted.
- Don’t use fertilizer to overcome poor growth associated with too much shade.

Acknowledgements

- Contributors: Dr. Amy Shober, Former UF/IFAS Soil Specialist; Dr. Jerry Kidder, Retired UF/IFAS Soil Specialist; Larry Figart, UF/IFAS Urban Forestry Agent
  Duval County
- Reviewers: Dr. Travis Shaddox, Asst. Professor, UF/IFAS Ft. Lauderdale Research and Education Center; Terry Delvalle, Urban Horticulture Agent, Duval County Extension; Mary Salinas, Urban Horticulture Agent, Santa Rosa County Extension; Joe Sewards, Urban Horticulture Agent, Volusia County Extension
- Sydney Park Brown, CLCE, (2018 Revision)