Demystifying the Soil Test

Presented by Julio Perez, UF/IFAS Extension Horticulture Agent I

UF | IFAS Extension
UNIVERSITY of FLORIDA

Florida-Friendly Landscaping™ PROGRAM

Today's Lessons

TOPICS WE WILL COVER

- Why soil testing is important
- Nutrients and their role in plant development
- Why is the pH important?
- Three available soil tests
- Interpreting the results
- Notes on fertilizer

Why soil testing is important

FOR THE ENVIRONMENT

- Too keep excess fertilizer and lime from contaminating our water ways and drinking water

FOR PLANT HEALTH

- Right Plant, Right Place
- What needs to be done to prepare the soil for planting
- Good first step in a plant diagnosis
- Address potential plant deficiencies

FOR THE WALLET

- Results give the amount of fertilizer needed
- Decreases the chance of over fertilizing

Nutrients and their role in plant development

MAJOR NUTRIENTS

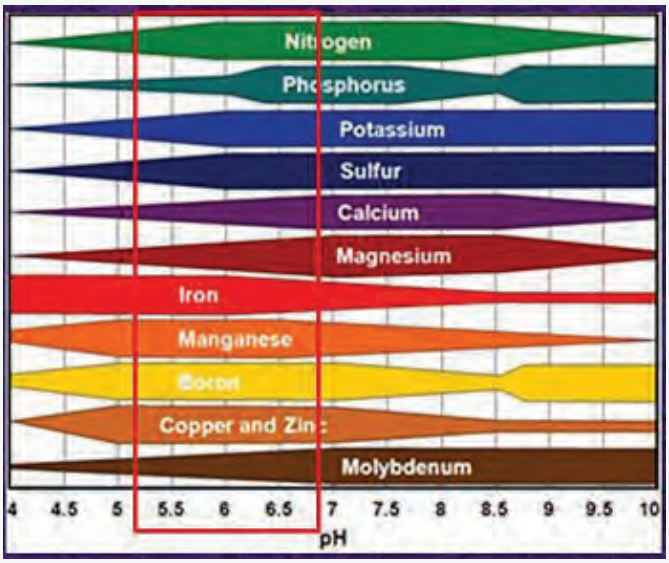
N: Nitrogen- plant metabolism, growth, health
P: Phosphorus- root development, flowering, and ripening
K: Potassium- water retention, plant structure, disease resistance

MINOR NUTRIENTS

CA: Calcium - Disease resistance, plant structure, fruit set, and environmental stress
S: Sulfur - Plant growth, seed formation, and disease resistance
Mg: Magnesium - Chlorophyll production, stress from extreme heat and sunlight, growth
B: Boron- Disease Resistance, sugar production, and plant growth
Mn: Manganese - Plant Structure, environmental stress, and disease resistance
Fe: Iron - Plant growth, chlorophyll production, and fruit quality and quantity
Cu: Copper - Chlorophyll and seed production and disease resistance
Cl: Chlorine - Decreases water loss and disease resistance
Zn: Zinc - Plant Resistance to diseases and pests
Ni: Nickle- Plant response to stress

Why is the pH important?

- pH influences nutrient availability of essential nutrients
- Some plants prefer low pH to assist with nutrient uptake.



Taken From "Landscape Basics: success with herbaceous Perennials" UGA Extension, https://extension.uga.edu/publications/detail.html?number=B1424&title=Landscape%20Basics:%20Success%20with%20Herbaceous%20Perennials

Three available soil tests

CONSIDER YOUR NEED

UF/IFAS Putnam County Extension pH Soil Test

Cost: Free (Limit of 5 per week)

Brief Description: This is a free service that is conducted by trained Master Gardener Volunteers.

This test only provides soil pH.

UF/IFAS Extension Soil Testing Lab- Test A: pH and Lime Requirement Test

Cost: $3 per sample + shipping sample to Soil Testing Lab

Brief Description: This is a service done at the UF/IFAS Extension Soil Testing Laboratory (ESTL) located at UF's Main Campus. This test will provide the soil's pH as well as liming recommendations, if appropriate.

UF/IFAS Extension Soil Testing Lab- Test B: Standard Soil Fertility Test

Cost: $10 per sample + shipping sample to Soil Testing Lab

Brief Description: This is a service done at the UF/IFAS Extension Soil Testing Laboratory (ESTL) located at UF's Main Campus. This test will provide a comprehensive analysis of the soil's nutrient make up, the soil's pH as well as provide liming recommendations.

UF/IFAS Putnam County Extension pH Soil Test

KEEP THESE IN MIND!

BEST FOR

- Initial planning/site selection
- Right plant/right place

BENIFITS

- Free for Putnam County Residents
- Gives a snapshot of soil pH
- Can help when identifying Nutrient related soil and plant issues
- Good first step when planning a flower bed, vegetable garden, or planting a tree

CONSIDERATIONS

- Does not include liming nor fertilizer recommendations
- May recommend sending sample tothe UF/IFAS Extension Soil Lab for additional testing

SOIL pH TEST FORM

Drop off Location_____

Contact Information (Name, Address, City, Zip, Phone and Email)

_____

_____

_____

Location of Soil Sample (Date, Address, City and Zip) ☐ Check box if same as contact info

_____

_____

_____

Preferred method of contact for results: ☐ E-mail ☐ Mailed Letter

If more than one soil sample is submitted, please lable each bag with a short ID that will help you reference the location where the sample was taken. Write the sample ID (from each sample bag) and the plant code in the table below.

Plant Codes			
A. Vegetable Garden	**B.** Herb/Flower Garden	C. Citrus*	**D.** Blueberries*
E. Peaches/Nectarines	**F.** Ornamental Shrubs*	**G.** Azaleas, Camellias*	**H.** Other*

Lawn Codes		
I. Bahia	**J.** Bermuda	**K.** Centipede
L. St. Augustine	**M.** Zoysia	

***Specify shrub/tree type, cultivar/variety or Other**_____

Sample ID	**Sample 1**	**Sample 2**	**Sample 3**	**Sample 4**	**Sample 5**
Plant/Lawn Code					
pH					

Hello Al E. Gator,

Below is the result of your soil test.

Soil pH Results		
Target pH for Citrus:	5.5-6.5	This is the ideal pH
Target pH for Oak Leaf Hydrangea:	4.5-6.5	
Sample 1: Citrus	6.01	pH of your sample in water medium.
Sample 2: Oak Leaf Hydrangea	6.02	

Recommendations:

- Please remember that this is only a test for pH which is just one component in garden chemistry. If you have been using this site for more than 3 years you may want to consider having the soil tested for nutrients levels. To do this you will need to send the sample to UF Soil testing lab in Gainesville. This test cost $10 and covers 8 nutrients plants need. Bags and required forms can be picked up at the extension building in East Palatka.

Sample 1: Citrus Recommendations:

- This sample's pH lies within the recommended range for Citrus.
- If you are experiencing yellowing leaves, it could be one or more of the following
  1. A nutrient deficiency
  2. An insect problem
  3. Pesticide drift
  4. Citrus Greening
- A plant sample may be needed to make a better diagnosis

Sample 2: Oakleaf Hydrangea Recommendations:

- This sample's pH lies within the recommended range for Oakleaf Hydrangea.
- There are several factors that could cause the OLH not to bloom:
  1. Winter pruning- pruning should be done in summer (usually after blooms have died).
  2. Though OLH are drought tolerant light watering during the spring will help with blooming.

UF/IFAS Extension Soil Testing Lab- Test A: pH and Lime Requirement Test

BEST FOR

- Initial planning/site selection
- Right plant/right place
- When liming may be needed
- Best done 4-6 weeks before applying lime to an area

BENIFITS

- Gives a snapshot of soil pH
- The report shows the current pH of the soil sample as well as a target pH (depending on intended plant species and use of the area)
- Provides suggested liming rate

CONSIDERATIONS

- Best done BEFORE planting and liming, but can be utilized to diagnose some problems of established plants
- Liming recommendations are usually given in pounds per 1000 square feet or per acre
- Additional calculations may be needed for smaller areas
- Does not provide nutrient levels nor fertilizer recommendations

Mailing Address (please print)

Name _____ Date _____

Address _____

_____, FL Zip _____ Phone _____

Email* _____
*Please provide an email address to receive your results faster.

Signature _____
(signature only required for UF personnel for approval of chartfield charges)

UF/IFAS Analytical Services Laboratories
Extension Soil Testing Laboratory

2390 Mowry Road/PO Box 110740/Wallace Building 631
Gainesville, FL 32611-0740
Email: soilslab@ifas.ufl.edu Website: http://soilslab.ifas.ufl.edu

Landscape and Vegetable Garden Test Form

Note: This lab only tests samples from Florida.

Direct any questions about this test or the interpretation of the results to your local UF/IFAS Extension agent.

Note:

- Consult an expert to determine if plant growth problems require soil testing.
- These samples will not be tested for nematodes, disease organisms, or chemicals other than those listed on this form.
- Commercial producers should use the Producers Soil Test Form SL135 (http://edis.ifas.ufl.edu/ss186).

Step 1. Collect samples from your landscape or garden. See the instructions at the bottom of this page.

Step 2. Choose **EITHER** Test A or B, but not both, for all samples.

Test A. The pH and Lime Requirement Test provides the following information:

- Soil pH
- Lime Requirement

Test A is appropriate if you do the following:

1. Use only complete fertilizers (such as 16-4-8).
2. Follow the generic fertilizer recommendations found in UF/IFAS landscape and vegetable garden publications.
3. Need only the soil pH test.

Test B. The Standard Soil Fertility Test provides the following:

- Soil pH
- Lime Requirement
- P, K, Ca, Mg, S, Cu, Mn, and Zn

Test B will enable you to tailor your use of single-element fertilizers based on existing soil fertility status. However, if you use a complete fertilizer, such as 10-10-10, the extra tests for extractable P, K, Mg, and Ca are of little value.

Fill in all requested information, using one line per sample. Use additional forms for more than 5 samples.

Remember: Choose either test A or B for each sample.

Lab Use Only	Sample ID	County	Crop Code(s) (See back of form)	Estimated Acreage	Cost of Test A	OR	Cost of Test B
					(Circle appropriate amount.)		
					$3	OR	$10
					$3	OR	$10
					$3	OR	$10
					$3	OR	$10
					$3	OR	$10

Check ○ Money Order ○ Cash ○ Total _____

Crop Code(s):

Crop Code	Lawns
72	Bahiagrass
73	Bermudagrass
74	Carpetgrass
75	Centipedegrass
76	Ryegrass
77	St. Augustinegrass
78	Zoysiagrass
Crop Code	**Landscape Plants and Vegetable Gardens**
603	Landscape azaleas, camellias, gardenias, hibiscus or ixora
67	Blueberries
62	Dooryard citrus
602	Woody ornamentals or trees in the landscape
90	Vegetable garden

Client Identification: 1

Set Number: E65634 Lab Number: E166839
Report Date: 25-May-21

Crop: Bahiagrass Lawn

SOIL TEST RESULTS AND THEIR INTERPRETATIONS

Target pH:	5.5 This is the pH at which the above crop will grow at its optimum
pH (1:2 Sample:Water)	4.4 This is the pH of your sample in the water medium
A-E Buffer Value:	7.32 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.

MEHLICH-3 EXTRACTABLE

		LOW	MED	HIGH
PHOSPHORUS	(mg/Kg or ppm P)			
POTASSIUM	(mg/Kg or ppm K)			
MAGNESIUM	(mg/Kg or ppm Mg)			
CALCIUM	(mg/Kg or ppm Ca)			

Only pH and Lime Requirement Test Requested

LIME AND FERTILIZER RECOMMENDATIONS

Crop: Bahiagrass Lawn

Lime:	79 lbs per 1000 sq. ft. per year
Nitrogen(N):	
Phosphorous(P_2O_5):	
Potassium(K_2O):	
Magnesium(Mg):	

UF/IFAS Extension Soil Testing Lab- Test B: pH and Lime Requirement Test

BEST FOR

- Initial planning/site selection
- Right plant/right place
- When liming may be needed
- Best done 4-6 weeks before applying lime to an area

BENIFITS

- The report shows the current pH
- Provides:
  - suggested liming rate
  - the level (amount) of 8 Nutrients
  - direct interpretation of some nutrients
  - additional information micronutrients
- fertilizer recommendations
- important directions to

contact information of your local UF/IFAS Extension Agent

CONSIDERATIONS

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- Recommendations are usually given in pounds per 1000 square feet or per acre additional calculations may be needed for smaller areas
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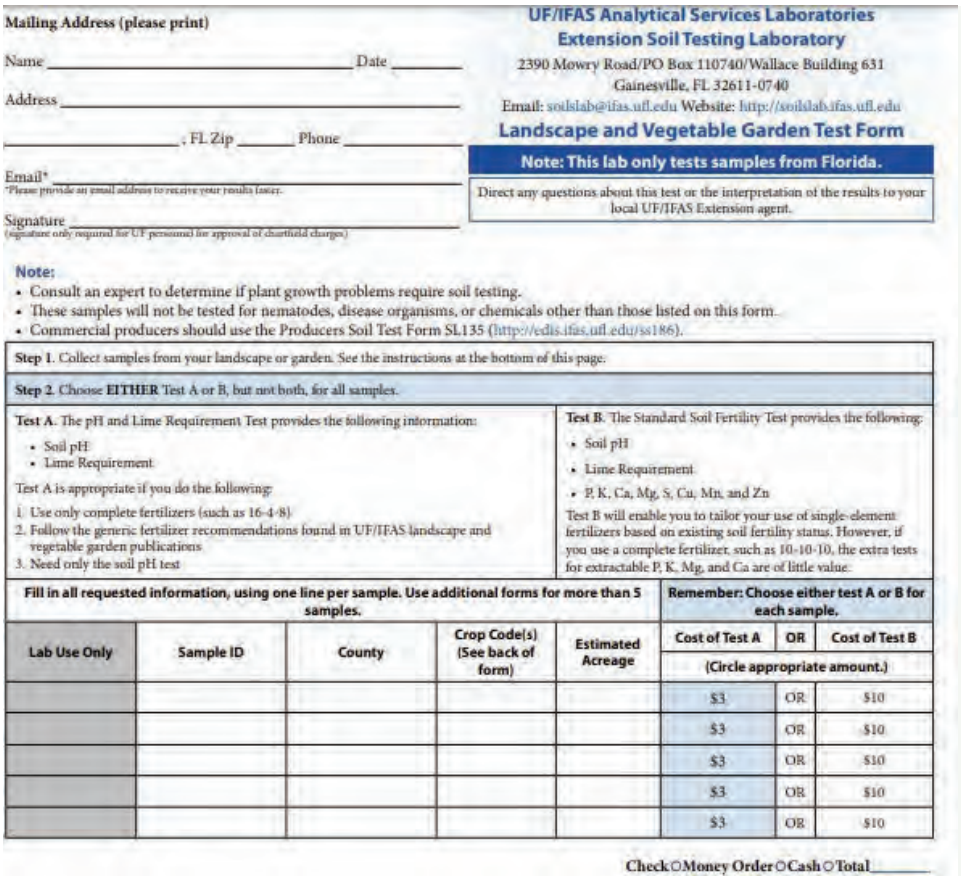

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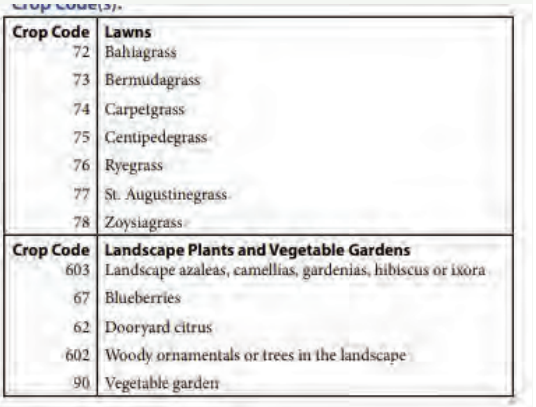
Check ○ Money Order ○ Cash ○ Total _____



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90	Vegetable garden

Client Identification: 4 BK Rt

Crop: **Zoysiagrass Lawn** Report Date: 25-May-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): 4.8	This is the pH of your sample in water medium
A-E Buffer Value:7.45	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

Soil Nutrients Mehlich-3 Extractable

Nutrients	Level mg/kg or ppm	Interpretation	Nutrients	Level mg/kg or ppm
Phosphorus (P)	137	**HIGH**	**Sulfur (S)**	33.7
Potassium (K)	54	**MEDIUM**	**Copper (Cu)**	0.8
Magnesium (Mg)	86	**HIGH**	**Manganese (Mn)**	7.2
			Zinc (Zn)	4.5
Calcium (Ca)	612	**Ca is typically adequate in Florida soils**		

*For these nutrients see directions on the following pages

Lime and Fertilizer Recommendations

Crop: Zoysiagrass Lawn

Lime:	**75**	**lbs per 1000 sq. ft. per year**
Nitrogen(N):	**2.50**	**lbs per 1000 sq. ft. per year**
Phosphorus(P_2O_5):	**0.00**	**lbs per 1000 sq. ft. per year**
Potassium(K_2O):	**1.00**	**lbs per 1000 sq. ft. per year**
Magnesium(Mg):	**0.00**	**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.

Caution: Your local county regulations and ordinances, if any, will supersede the recommendations made in this report. Please contact your local county extension office for further clarifications.

IMPORTANT: Please read the directions on the following page(s) carefully, if any nutrient applications are made. If you have any questions, please call the county extension agent listed above.

Prior to making any of the above recommended applications, it is important to read carefully the following footnotes and follow the directions provided on fertilizer applications, timing, doses, sources, sulfur and micronutrients, irrigation, etc.

Directions

Sample Number: 166799 **Crop: Zoysiagrass Lawn**

General

- For details on fertilization, obtain UF/IFAS publication SL21, "General recommendations for Fertilization of Turfgrasses on Florida Soils." The publication is available on the web at http://edis.ifas.ufl.edu/pdffiles/LH/LH01400.pdf or from county Extension offices.

These rates are for normal, healthy lawns. These rates may be doubled in certain regions of the state for high maintenance turf.

Divide annual rates into 2 to 8 applications depending on location and management levels. Apply no more than 1.0 lb N/1000 sq. ft. per application.

Available Phosphate: A maximum rate of 0.25 lb per 1000 sq. ft per application, not to exceed 0.5 lb per 1000 sq. ft. annually.

Lime Requirement

- Recommendations are based on the Adams-Evans lime requirement test which is run on all mineral soils. When the recommended amount of lime is incorporated in the surface 6 inches of soil, soil pH should adjust to a level above which additional liming benefit is not expected. Excessive applications of lime can result in nutritional disorders.

Sulfur

- Application of sulfur is not required if test value is greater than 6.0 mg/kg or ppm. If the soil test value is less than

6.0 mg/kg or ppm apply sulfur as shown below:

Fertilizer should contain 15 to 20 lb sulfur/A. Apply as a sulfate (eg. gypsum, ammonium sulfate, magnesium sulfate, potassium sulfate, potassium magnesium sulfate), since elemental sulfur will react too slowly to supply the sulfur needs of the current crop.

GUIDANCE ON MICRONUTRIENTS

The IFAS Extension Soil Testing Laboratory currently offers a soil test for three micronutrients, copper (Cu), manganese (Mn), and zinc (Zn). Interpretations in terms of plant needs of the particular nutrients are still quite tentative. They are presented here with the understanding that other criteria such as crop production records and observation of deficiency symptoms should be used along with the test results in reaching the management decision concerning micronutrient fertilization.

Interpretation of extractable Cu, Mn, and Zn depends on the soil pH. The critical soil levels for these nutrients increase with pH for crops grown on acid sandy soils of Florida. Micronutrient availability in the alkaline pH range is better evaluated with a plant tissue test or with soil test extractants developed especially for alkaline soils.

Indiscriminate use of micronutrient soil tests should be avoided. However, if plant performance has been less than optimum in the past and the soil test levels are below those shown in the tables, fertilization with the respective micronutrients may be indicated.

COPPER

In Florida, Cu deficiencies have been generally confined to soils high in organic matter and so-called "new ground" just coming into cultivation in the flatwood areas. Known Cu phytotoxicity occurs in citrus groves and vegetable crop areas where Cu applied in fungicides and fertilizers has accumulated in the soil over the years. Liming to pH 7.0 is the simplest means of overcoming phytotoxicity.

Table 1 provides guidelines for interpreting the IFAS Micronutrient Soil Test values for extractable Cu in mineral soils. Dilute acids are poor extractants of Cu on organic soils and do not give reliable estimates of crop responses. The IFAS Soil Testing Lab does not presently provide a Cu soil test for organic soils.

Application of 3 to 5 pounds elemental Cu per acre (as copper sulfate or finely ground copper oxide) will correct Cu deficiencies in most crops growing on mineral soils. Mixing these Cu sources with macronutrient fertilizers presents no agronomic problems, provided segregation of the materials is avoided. A single Cu application may be sufficient for several years. Do not repeat this application until soil or tissue tests indicate a need for Cu. Copper added to soil is there "forever" and Florida already has too many cases of soils with phytotoxic levels of Cu. Fertilizer Cu should not be applied to mineral soils where Cu will be used as a pesticide.

Table 1. Tentative interpretation of extractable Cu in mineral soils

	Soil pH Minerals Soils Only		
	5.5-6.0	6.0-6.5	6.5-7.0
	ppm		
Level below which there may be a crop response to applied Cu	0.1-0.3	0.3-0.5	0.5*
Level above which Cu phytotoxicity may occur	2.0-3.0	3.0-5.0	5.0**

*If in doubt about copper nutrition of crop, get a tissue test

Decoding the Tests

UTILIZING pH RESULTS

- Do not over lime or guess on lime.
- If you are with .3 of the targe pH you may not want to lime.
- Make sure you look at the rate.
- You may want to lay the lime over several applications

Decoding The Nutrients

NUTRIENTS TO PAY ATENTION TO

- Nitrogen deficiencies are normally not to much of an issue so it is not analyzed
- P, K, Mg are the most common nutrients our soils are deficient in.
- Test gives the amount that was in the soil and if that level is considered High, Medium or Low.
- If the are considered low you will see fertilizer recommendations.

LIME AND FERTILIZER RECOMMENDATIONS

- The fertilizers recommendations are given based on how they are available
- Make sure you look at the rate of applications. (lbs/1000 square feet)

Other nutrients analyzed are not of major concern. Cases to look at these would be presence of nutrient deficiency, or if used for disease control (Copper)

Client Identification: 4 BK Rt
Crop: **Zoysiagrass Lawn**

Soil Test Results and T

Target pH: 6.5	This is the pH at which the ab
pH (1:2 Sample:Water): 4.8	This is the pH of your sample
A-E Buffer Value:7.45	Buffer pH is the pH of your so determine the lime requirem level desired by the crop. If th determined

Soil Nutrients Mehl

Nutrients		Level mg/kg or ppm	Interpretation
Phosphorus	(P)	137	**HIGH**
Potassium	(K)	54	**MEDIUM**
Magnesium	(Mg)	86	**HIGH**
Calcium	(Ca)	612	**Ca is typically adequ**

Lime and Fertilizer R

Crop: **Zoysiagrass Lawn**

Lime:	**75**	**lbs per 1000 sq. ft. per year**
Nitrogen(N):	**2.50**	**lbs per 1000 sq. ft. per year**
Phosphorus(P_2O_5):	**0.00**	**lbs per 1000 sq. ft. per year**
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Magnesium(Mg):	**0.00**	**lbs per 1000 sq. ft. per year**

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Decoding the Fertilizer label

LOOK AT THE NUMBERS FIRST

- The large numbers corrispond to N, P2O5, and K2O
- They are percentages
- Note the pounds of the mix
- In this bag there is 7.5 pounds of each N, P2O5, and K2O

LOOK AT THE GUARTEED ANALYSIS

Look for more slow release than quick release

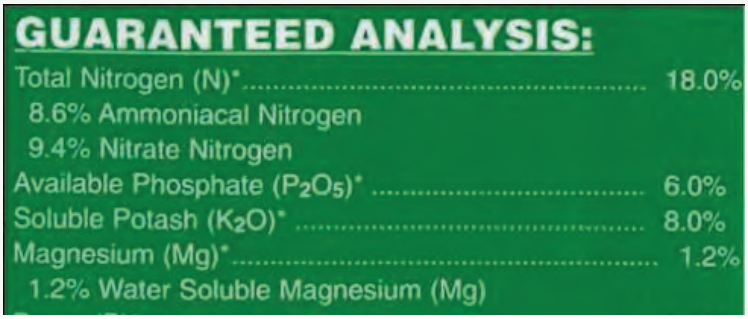
REFER BACK TO YOUR SOIL TEST

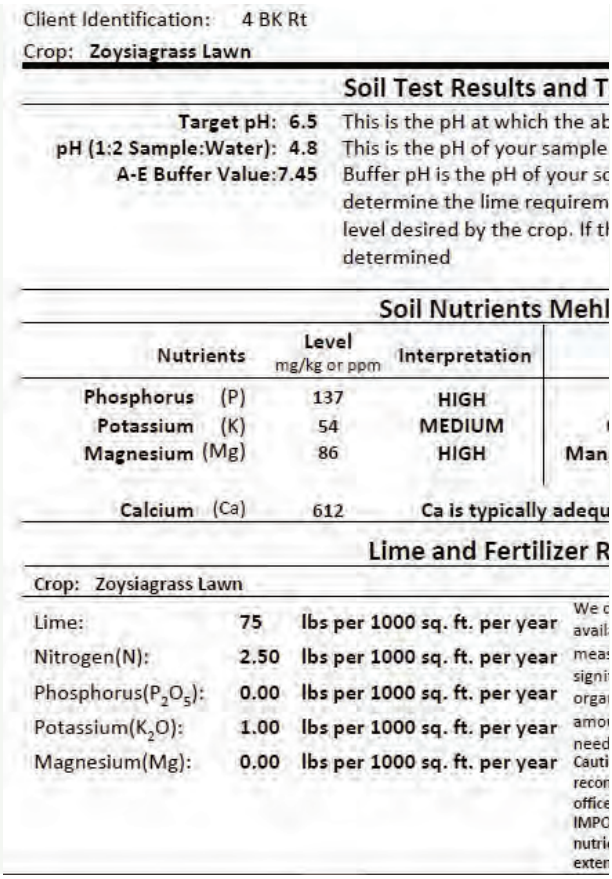
Your soil test will give guidance on what nutrients you need. Phosphorus is ussually very prevalent in our soils there fore you may not need any in your fertilizer.

Putting it together

SELECTING A FERTILIZER

- Find a ratio that is close to the recommendations.
  - 2:0:1 ratio
  - 20-0-10
  - 24-2-11
- Percentage of Magnesium can also be found in the analysis.





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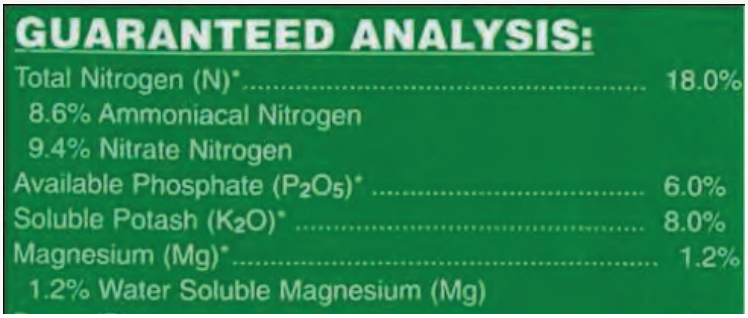
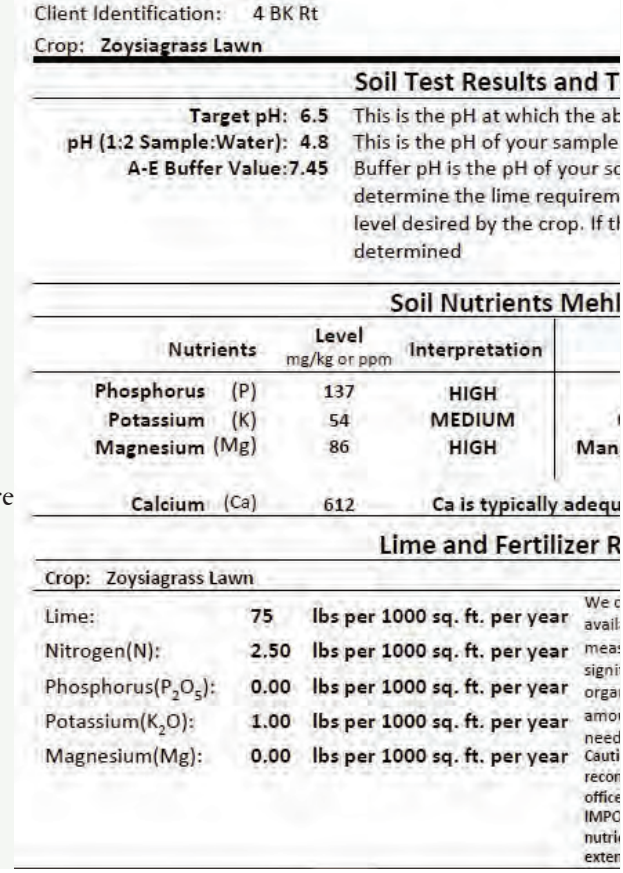
Some math needed

HOW MUCH FERTILIZER

- 50 lb bag of the fertilizer below
  - 18-6-8
  - 9lb total Nitrogen, 3lb P2O5, 4 lbs of K2O
  - Fl Law states nor more than one pound per 1000 sq feet
- Percentage of Magnesium can also be found in the analysis.

Nitrogen is limiting 1 lb per 1000 square feet at a time:
1/.18= 5.5 of the fertilizer to meet this requirement
50/5.5= 9 9x1000= 9000 square feet at 1 pound of nitrogen per 1000 square feet





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Target pH:	**6.5**	This is the pH at which the ab
pH (1:2 Sample:Water):	**4.8**	This is the pH of your sample
A-E Buffer Value:	**7.45**	Buffer pH is the pH of your so determine the lime requirem level desired by the crop. If th determined

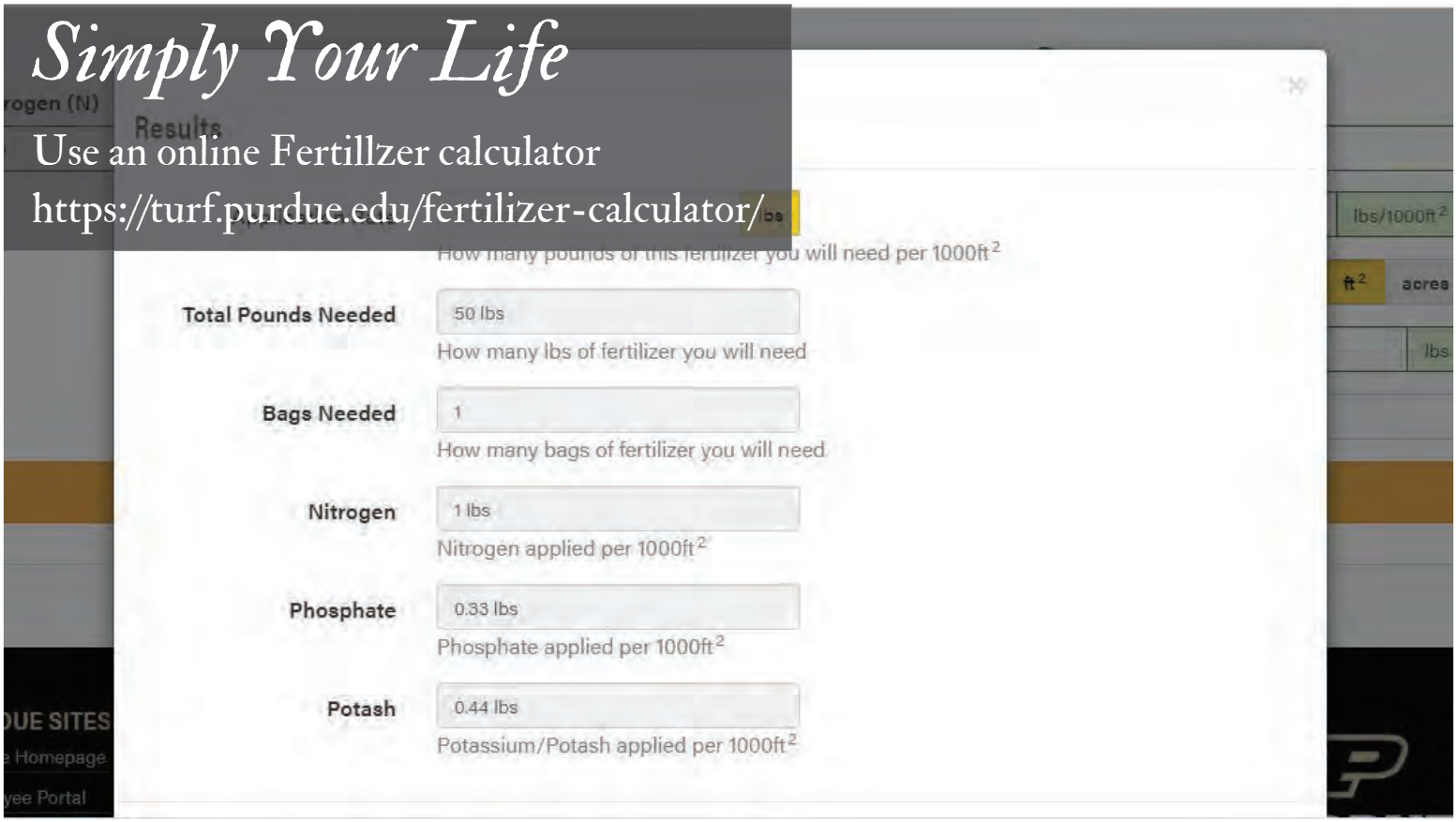
Soil Nutrients Mehl

Nutrients		Level mg/kg or ppm	Interpretation	
Phosphorus	(P)	137	HIGH	
Potassium	(K)	54	MEDIUM	
Magnesium	(Mg)	86	HIGH	Man
Calcium	(Ca)	612	Ca is typically adequ	

Lime and Fertilizer R

Crop: Zoysiagrass Lawn

Lime:	75	lbs per 1000 sq. ft. per year	We c avail
Nitrogen(N):	2.50	lbs per 1000 sq. ft. per year	meas signi
Phosphorus(P_2O_5):	0.00	lbs per 1000 sq. ft. per year	orga
Potassium(K_2O):	1.00	lbs per 1000 sq. ft. per year	amo need
Magnesium(Mg):	0.00	lbs per 1000 sq. ft. per year	Cauti recor office IMPO nutri exter



Additional Readings

SOIL TESTING FOR PLANT-AVAILABLE NUTRIENTS—WHAT IS IT AND WHY DO WE USE IT?

George Hochmuth, Rao Mylavarapu, and Ed Hanlon2

https://edis.ifas.ufl.edu/pdf/SS/SS62100.pdf

SOIL SAMPLING AND TESTING FOR THE HOME LANDSCAPE OR VEGETABLE GARDEN

Amy L. Shober and Rao Mylavarapu

https://edis.ifas.ufl.edu/pdf/SS/SS49400.pdf

HOMEOWNER BEST MANAGEMENT PRACTICES FOR THE HOME LAWN

Laurie E. Trenholm

https://edis.ifas.ufl.edu/publication/EP236

QUESTIONS?

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