Predictive & Diagnostic Nutrient Testing for Florida

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Nutrient Testing Program

- Offered as an educational component through Cooperative Extension Service as a part of Landgrant University mission

- All states have soil testing programs, and most include associated soil/tissue/waste/manure/ water testing facilities

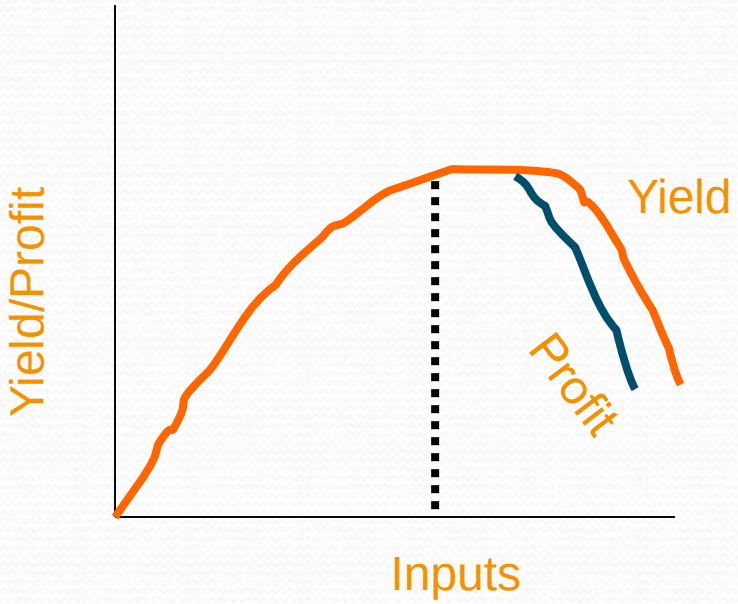
IFAS Extension Soil Testing Laboratory

Mission….

"to serve citizens of Florida by providing selected soil, plant, water and waste testing interpretation and recommendation as an educational service through cooperative extension to guide management decisions affecting lime and fertilizer use efficiency"

Optimum Yield or Quality

- Optimum ideally should refer to economic and environmentally sustainable returns
- Existing approaches have been predominantly based on economics



Fertilization Philosophy

- Basic Cation Saturation Ratio
- Buildup and Maintenance
- Field Hydroponics
- Crop Nutrient Requirement

Fertilization Philosophy

Basic Cation Saturation Ratio

- There are ideal ratios of basic (Ca, Mg, and K) in the soil at which maximum yields occur
- Fertilizers are used to adjust soil-test results
- Popular with commercial laboratories
- Ratios are easy to calculate
- Always require fertilizer

Fertilization Philosophy

Crop Nutrient Requirement

- Each nutrient must be supplied in adequate but non-excessive amounts to achieve optimum crop response
- The contribution of the soil is measured indirectly by a calibrated soil test
- Fertilizers are used only to supplement soil fertility
- Used by many Land-Grant and some commercial laboratories

Crop Removal vs. Crop Nutrient Requirement

- No Soil Testing
- Always Fertilize
- Luxury Consumption
- Pollution Potential Hi
- Treats soil as a bank

- Calibrated Soil Test
- Fertilizer amounts adjusted for soil contribution
- Based on plant need, not plant uptake
- Pollution Potential Lo
- Fertilize the plant not the soil

Field Calibration

Interpreting pre-plant soil-test values
to
FERTILIZER RECOMMENDATIONS
in the field for Crop Response

Soil testing within the Lab is a 3- step process

1. Analysis and computation of test results
2. Interpretation of the results
3. Nutrient Recommendations

preceded by establishing precise purpose of soil testing and representative soil sampling

A. Analytical Procedures

- Chemical extraction of nutrients from the soil
  - Extraction procedure is expected to mimic release of nutrients from the soil
  - Extracted amounts of nutrients are calibrated with crop production
  - Extraction methods are specific to soils
  - Different extractants are developed for different soils

Soil Extractants Used in Florida

- Acid soils - Mehlich-3

  (acetic acid, ammon. flouride, nitric acid, EDTA, ammon. nitrate)

  -P, K, Ca, Mg, Cu, Zn, Mn

- Calcareous soils (pH ≥7.4)- AB-DTPA (Ammonium Bicarbonate-DTPA)

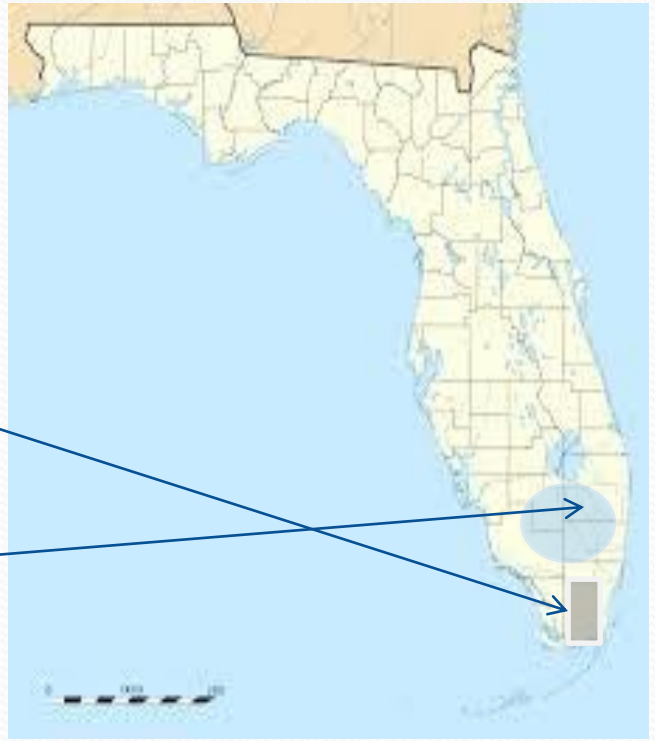
  -P only

- Organic soils (IFAS EREC, Belle Glade)

  -Mehlich-3 extraction for P for sugarcane

  -Water extraction for P for all other crops

  -Acetic Acid for K, Mg, Ca, Na, Si



B. Interpretation

- INTERPRETATION of test results is the sole purpose of Soil Testing Programs
- Computed test results are categorized into levels of adequacy based on –

  "Crop Nutrient Requirement"

- These interpretations are obtained through field research on soil test and crop response- "field calibration"

C. Nutrient Recommendations

- **Based on the test interpretation, nutrients may be recommended**
- **Where relevant, lime requirement will be calculated and recommended**
- **Recommendations are based on Crop Nutrient Requirement**

Mehlich Extraction Methods

- Dr. Adolf Mehlich, worked as a consultant at the North Carolina Department of Agriculture during the 1950s and 70s
- Developed Mehlich-1, Mehlich-2 and Mehlich-3 series of soil extractants for the acid soils of the United States, each one as an improvement over the previous in sequence
- While Mehlich-2 failed completely right at the outset, Mehlich-1 and Mehlich-3 were found effective

Comparison- M1 & M3 Interpretative Charts

Interpretation for Mehlich-1 soil test results for agronomic and vegetable crops

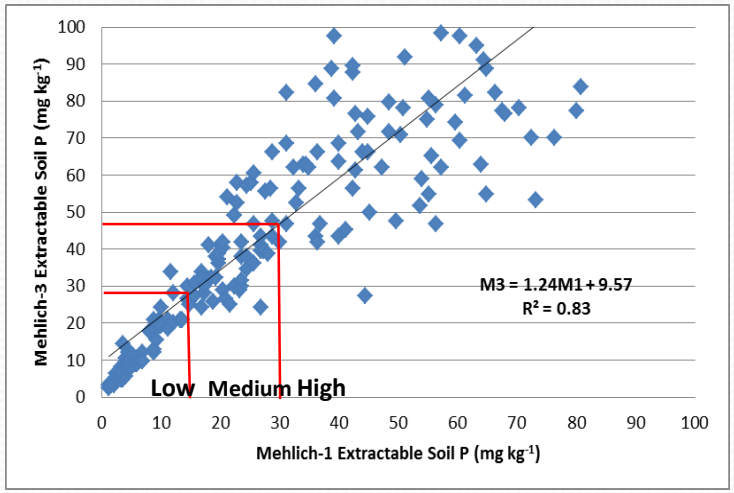
	Very Low	Low	Medium	High	Very High
	----------ppm----------				
P	<10	10-15	16-30	31-60	>60
K	<20	20-35	36-60	61-125	>125
Mg	--	<15	15-30	>30	

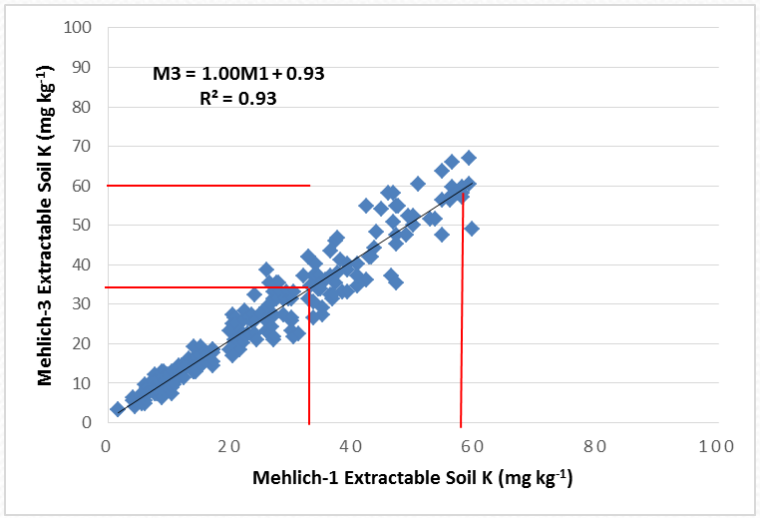
Interpretation for Mehlich-3 soil test results for agronomic and vegetable crops

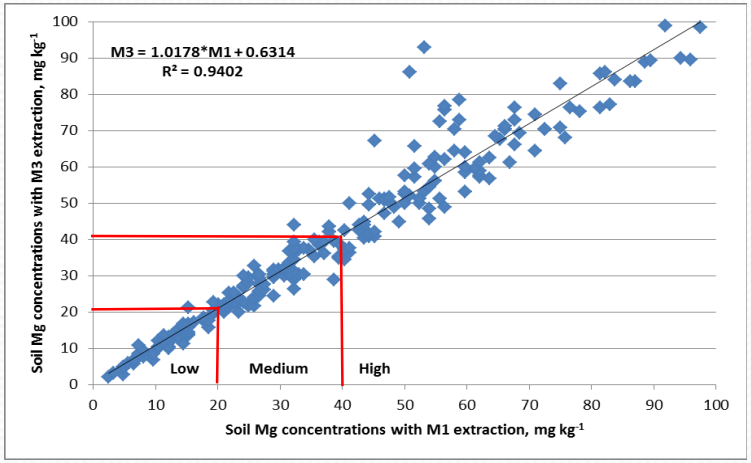
Nutrient	LOW	MEDIUM	HIGH
P	≤25	26-45	>45
K	≤35	36-60	>60
Mg	≤20	21-40	>40

Comparison of Mehlich 1 & 3

	Mehlich-1	Mehlich-3
Valid pH Range	pH<6.5	Most normal soil ranges
Extraction of P	Limited in high Fe and Al accumulations	Fluoride facilitates dissociation of phosphates from Fe and Al oxides
Extraction of Micronutrients	Dilute acid mixture, only some micronutrients extracted	EDTA (chelate) extracts micronutrients
Exchangeable Cations	Poor extractant for high CEC soils	Ammonium nitrate extracts exchangeable cations


Mehlich-3 Extractable Soil P (mg kg-1)
Mehlich-1 Extractable Soil P (mg kg-1)
M3 = 1.24M1 + 9.57
R² = 0.83
Low
Medium
High


Mehlich-3 Extractable Soil K (mg kg-1)
Mehlich-1 Extractable Soil K (mg kg-1)
M3 = 1.00M1 + 0.93
R² = 0.93


Soil Mg concentrations with M3 extraction, mg kg-1
Soil Mg concentrations with M1 extraction, mg kg-1
M3 = 1.0178*M1 + 0.6314
R² = 0.9402
Low
Medium
High

Lime Recommendation

- Adams-Evans Buffer (pH: 8.0)
- Buffer pH and Water pH values are used to calculate the lime requirement to raise the soil pH to the desired target pH value based on the crop grown
- Buffer pH is therefore not determined in every case

Nitrogen

- For N, there is no reliable soil test method
- N recommendation is based on crop response to applied N fertilizer; no test for N at the ESTL
- Soil samples should NOT be submitted to the ESTL for N-test
- A general comment to this effect is printed on all the soil test reports

General Comment on all Reports

"These interpretations are based on soil test results and research/experience with the specified crop under Florida's growing conditions. 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."

UF/IFAS Analytical Services Laboratories
Extension Soil Testing Laboratory
Wallace Building 631 PO Box 110740 Gainesville, FL 32611-0740
Email: soilslab@ifas.ufl.edu Web: soilslab.ifas.ufl.edu Phone #:352-392-1950

Landscape & Vegetable Garden Test

TO:

For further information contact:
Wilber, Wendy L
Alachua County Coop Extn Service
2800 NE 39 Ave
Gainesville, FL 32609-2658
Tel: 352-955-2402
Email: wilbewl@ufl.edu

Client Identification: #1 North Slope Set Number: E21516 Lab Number: E50488

Crop: Landscape Azaleas, Camellias, Gardenias, Hibiscus, or Ixora Report Date: 27-Nov-13

SOIL TEST RESULTS AND THEIR INTERPRETATIONS

Target pH: 5.5
pH (1:2 Sample:Water) 7.0
A-E Buffer Value: N/A

MEHLICH-3 EXTRACTABLE			V LOW	LOW	MED	HIGH	V HIGH
PHOSPHORUS	(ppm P)	> 201				*********	
POTASSIUM	(ppm K)	51				*********	
MAGNESIUM	(ppm Mg)	117				*********	
CALCIUM	(ppm Ca)	> 2615					

LIME AND FERTILIZER RECOMMENDATIONS

Crop:	Landscape Azaleas, Camellias, Gardenias, Hibiscus or Ixora	
Lime:	0.0	lbs per 1000 sq. ft (1 Ton = 2000 Lbs)
Nitrogen:	1.10	lbs per 1000 sq. ft.
Phosphorus:(P_2O_5)	0	lbs per 1000 sq. ft.
Potassium: (K_2O)	0	lbs per 1000 sq. ft.
Magnesium: (Mg)	0	lbs per 1000 sq. ft.

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Producer Soil Test

For further information contact:

Client Identification: Intrd-Drout Set Number: E20679 Lab Number: E48591

Crop: Cool season Legumes or Legume-grass mixtures Report Date: 03-Dec-13

SOIL TEST RESULTS AND THEIR INTERPRETATIONS

Target pH:	6.5
pH (1:2 Sample:Water)	5.2
A-E Buffer Value:	7.48

MEHLICH-3 EXTRACTABLE			V LOW	LOW	MED	HIGH	V HIGH
PHOSPHORUS	(ppm P)	> 154				*********	
POTASSIUM	(ppm K)	22		*********			
MAGNESIUM	(ppm Mg)	7		*********			
CALCIUM	(ppm Ca)	72					

LIME AND FERTILIZER RECOMMENDATIONS

Crop:	Cool season Legumes or legume-grass mixtures(clovers,lupines,vetches)		
Lime:	3655.0	lbs per acre (1 Ton = 2000 Lbs)	(Dolomitic Lime Recommended)
Nitrogen:	0	lbs per acre	
Phosphorus(P_2O_5)	0	lbs per acre	
Potassium: (K_2O)	160	lbs per acre	
Magnesium: (Mg)	35	lbs per acre	

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Wallace Building 631 PO Box 110740 Gainesville, FL 32611-0740

Email: soilslab@mail.ifas.ufl.edu Web: soilslab.ifas.ufl.edu

Name:
Address:
City:

PrintDate:
SetNum:

Elements Reported as mg / kg in the Soil

LabNum	SampleID	Cu	Mn	Zn
	1	0.97	12.86	2.65
	2	1.75	15.28	1.91
	3	1.14	17.20	2.32
	16	2.03	19.33	2.50

Email: michelleatkinson@ufl.edu

Client Identification: 1 "New" Set Number: E32941 Lab Number: E79777

Report Date: 10-Oct-15

Crop: Zoysiagrass Lawn

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) 8.2 This is the pH of your sample in the water medium

A-E Buffer Value: 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. However since your samples' pH is higher than the target, the AE buffer pH is not applicable.

AB-DTPA Extractable Nutrients		LOW	MED	HIGH
PHOSPHORUS (mg/Kg or ppm P)	15			
POTASSIUM (mg/Kg or ppm K)	87			
MAGNESIUM (mg/Kg or ppm Mg)	30			
CALCIUM (mg/Kg or ppm Ca)	364			

LIME AND FERTILIZER RECOMMENDATIONS

Crop: Zoysiagrass Lawn

Lime: 0.00 lbs per 1000 sq. ft

Nitrogen: 2.00 lbs per 1000 sq. ft.

Phosphorous(P_2O_5): 0.00 lbs per 1000 sq. ft.

Potassium(K_2O): 0.00 lbs per 1000 sq. ft.

Magnesium(Mg): 0.46 lbs per 1000 sq. ft.

The above recommendations for K and Mg are provided based on the crop needs since no interpretation for these nutrients was found using AB-DTPA extraction method. Nitrogen recommendation is based on research data not on any soil test. The soil has been determined to be calcareous in nature because of its pH(>=7.4). At this pH, AB-DTPA extraction method was found suitable. However, only Phosphorus(P) was calibrated. No calibration was possible for Potassium(K) and Magnesium(Mg). Therefore, the recommendations for K and Mg are provided solely for successful crop performance and yields. Nitrogen(N) recommendations are provided based on research data and not on a soil test. Research studies are underway at different locations in the state to identify an appropriate extraction method for improved interpretations and recommendations for these soils. At that time, the recommendations will be modified, as appropriate.

For further information, please contact:

Dr. Yuncong Li, soils specialist, UF/IFAS TREC-Homestead

18905 SW 280 St, Homestead, FL 33031

Email: Yunli@ufl.edu Fax: 305-246-7003

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FootNotes.

12/03/13

NoteNum	Description
1	Soil test values noted with a ">" sign exceeded the normal working range of our extraction method and are interpreted as high or very high for P, K, or Mg. No positive plant response to addition of the nutrient is likely. In some circumstances, addition of this nutrient to the soil could be detrimental to plant performance or to the environment.
250	Indicated fertilizer amounts, and the nutrients already in the soil, will satisfy the crop nutrient requirement for this cropping season. Fertilizer and water management are linked. Maximum fertilizer efficiency is achieved only with close attention to water management. Supply only enough irrigation water to satisfy crop requirements. Excess irrigation may result in leaching of N and K creating possible plant deficiencies. Overfertilization has been shown to reduce vegetable quality. For subsurface irrigation, maintain a constant water table between 18 (at planting) and 24 inches (near harvest) below the top of the bed. Monitor water table depth and do not fluctuate, else N can be "scrubbed" from the root zone. On soils that have not been in vegetable production within the past 2 years, or where micronutrients are known to be deficient, apply 5 lb Mn, 3 lb Zn, 4 lb Fe, 3 lb Cu, and 1.5 lb B/A. Use soil testing to monitor micronutrient status every 2 years. When deciding about micronutrient applications, consider micronutrients added to the crop via fungicides. Some micronutrients can build up in the soil -- avoid micronutrient toxicity. Up to 40 lb/acre Mg might be needed when soil test is medium or lower in Mg. Mg can be supplied in fertilizer or from dolomitic limestone, when liming is recommended. Calcium concentrations are typically adequate in most soils used continuously for vegetable production or where the Mehlich-1 Ca index is >300 ppm. Calcium is added during liming activities and from calcium carbonate present in irrigation water drawn from aquifers in Florida. These sources should be considered in the determination of Ca fertilizer needs.
251	For unmulched crops, fertilizer should be applied in split applications to reduce leaching losses and lessen danger of fertilizer burn. Broadcast all P2O5 and micronutrients, if any, and 25 to 30% of the N and K2O in the bed at planting. Apply remaining N and K2O in sidedress bands during the early part of the growing season. Additional, supplemental sidedress applications of 30 lb N/A and 20 lb K2O/A

Comment

- UF/IFAS fertilization and liming recommendations are advisory in nature and emphasize efficient fertilizer use and environmentally sound nutrient management without losses of yield or crop quality. It is generally assumed the nutrients will be supplied from purchased, commercial fertilizer and the expected crop yields and quality will be typical of economically viable production. Growers should consider IFAS recommendations in the context of their entire management strategy, such as return on investment in fertilizer and the benefits of applying manure or biosolids (sewage sludge) to their land.
- There is insufficient research available to support the use of UF/IFAS soil test results for environmental nutrient management purposes. Such use is discouraged until correlation is proven.

Tissue Analysis

- Tissue analysis is routinely used to monitor plant nutrient uptake, both seasonals, annuals and perennials
- Linked to physiological stages of the plants
- Used as a diagnostic tool for perennial crops such as fruit trees, turf grasses, etc.
- ESTL provides tissue testing to growers when an IFAS Specialist can help interpret the results

Analytical Procedures for Plant Tissues

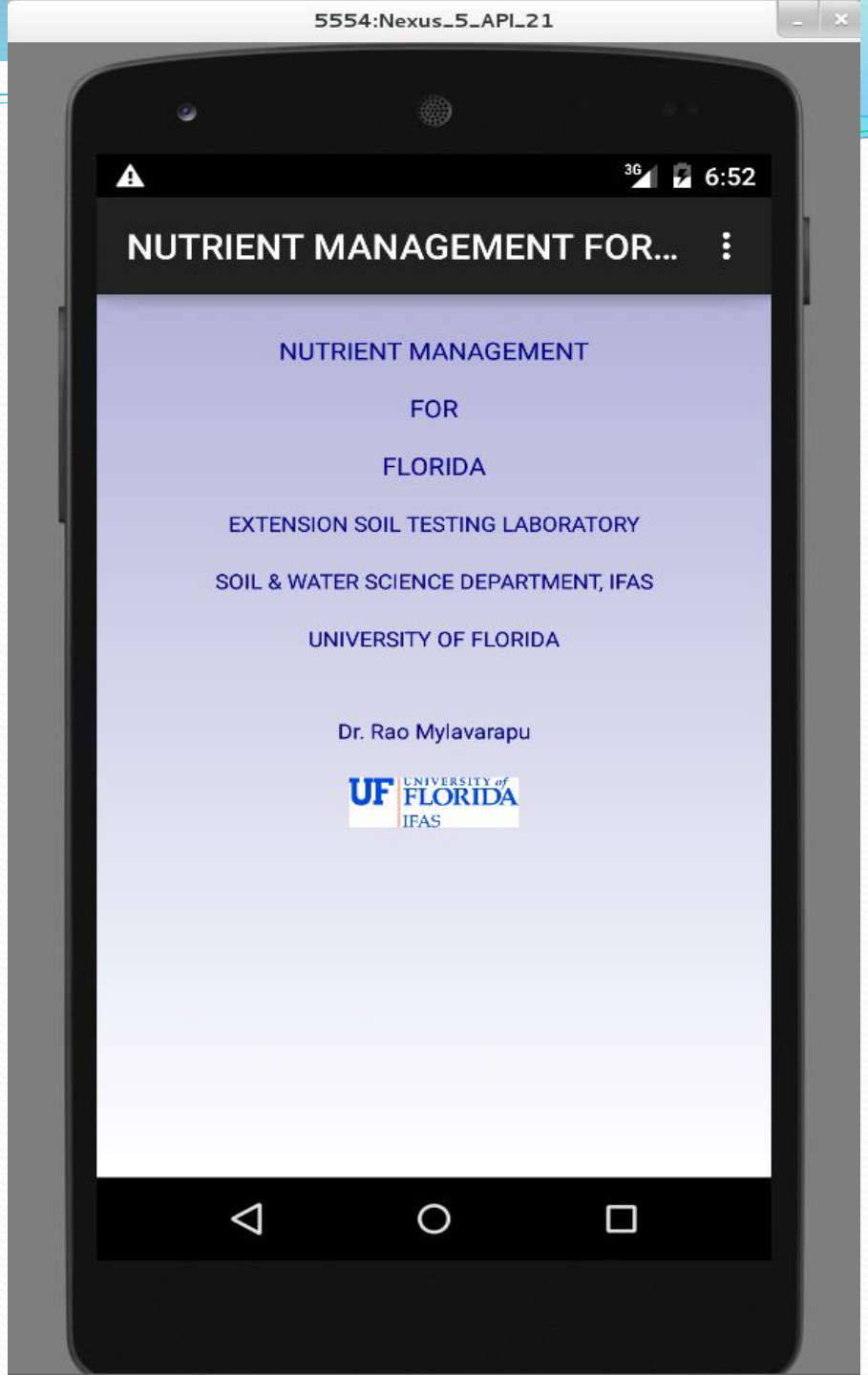
- Standard Determination of Ca, Mg, P, K, Na, Mn, Cu, Fe, Zn, and B in Plant Tissue- digestion in HCl

  -1.0g tissue

- Total Kjeldahl Nitrogen (TKN)- digestion in H_2SO_4

  -0.2g tissue

- Total N- Combustion method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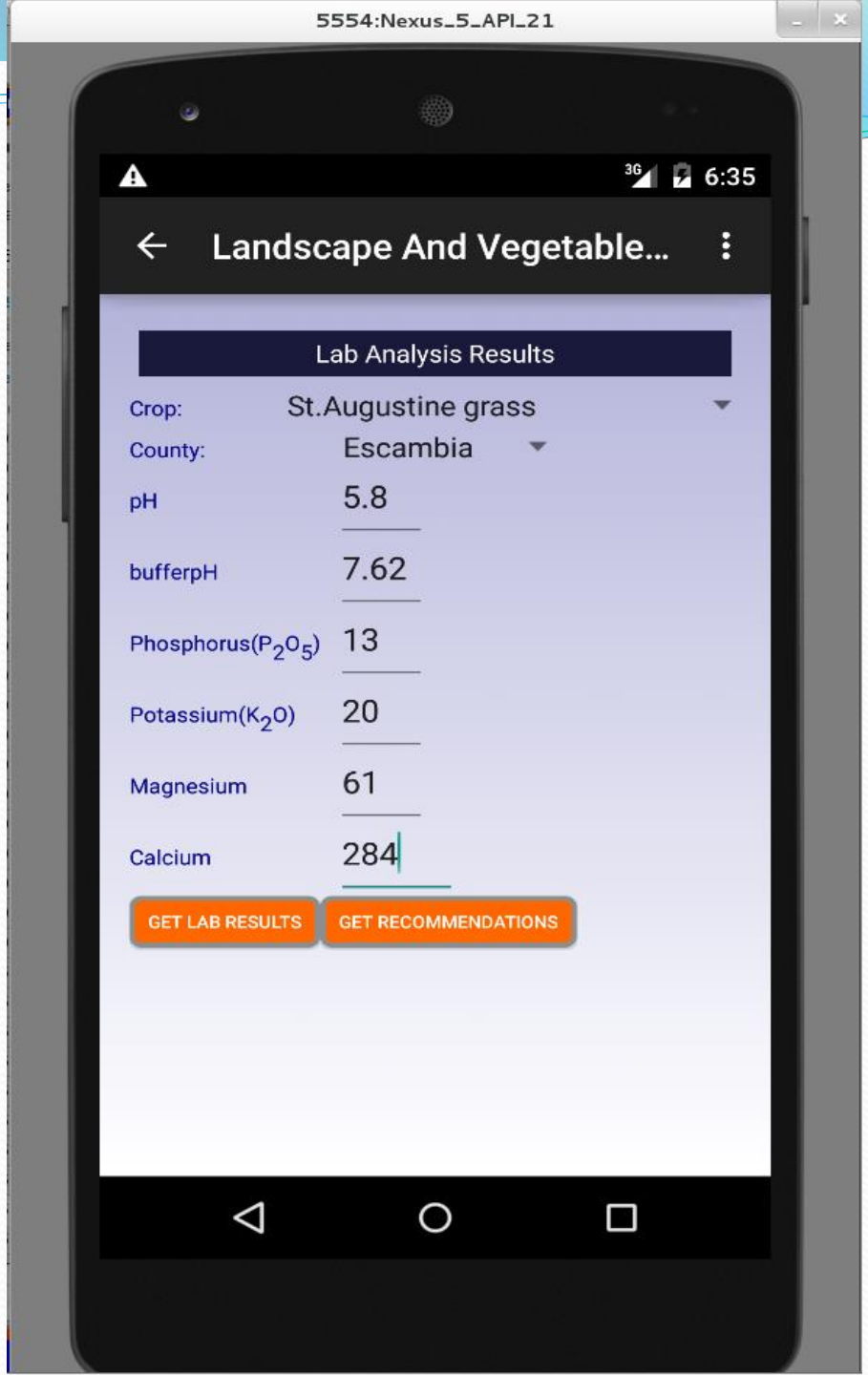
NUTRIENT MANAGEMENT FOR...
NUTRIENT MANAGEMENT
FOR
FLORIDA
EXTENSION SOIL TESTING LABORATORY
SOIL & WATER SCIENCE DEPARTMENT, IFAS
UNIVERSITY OF FLORIDA
Dr. Rao Mylavarapu
UF UNIVERSITY of FLORIDA
IFAS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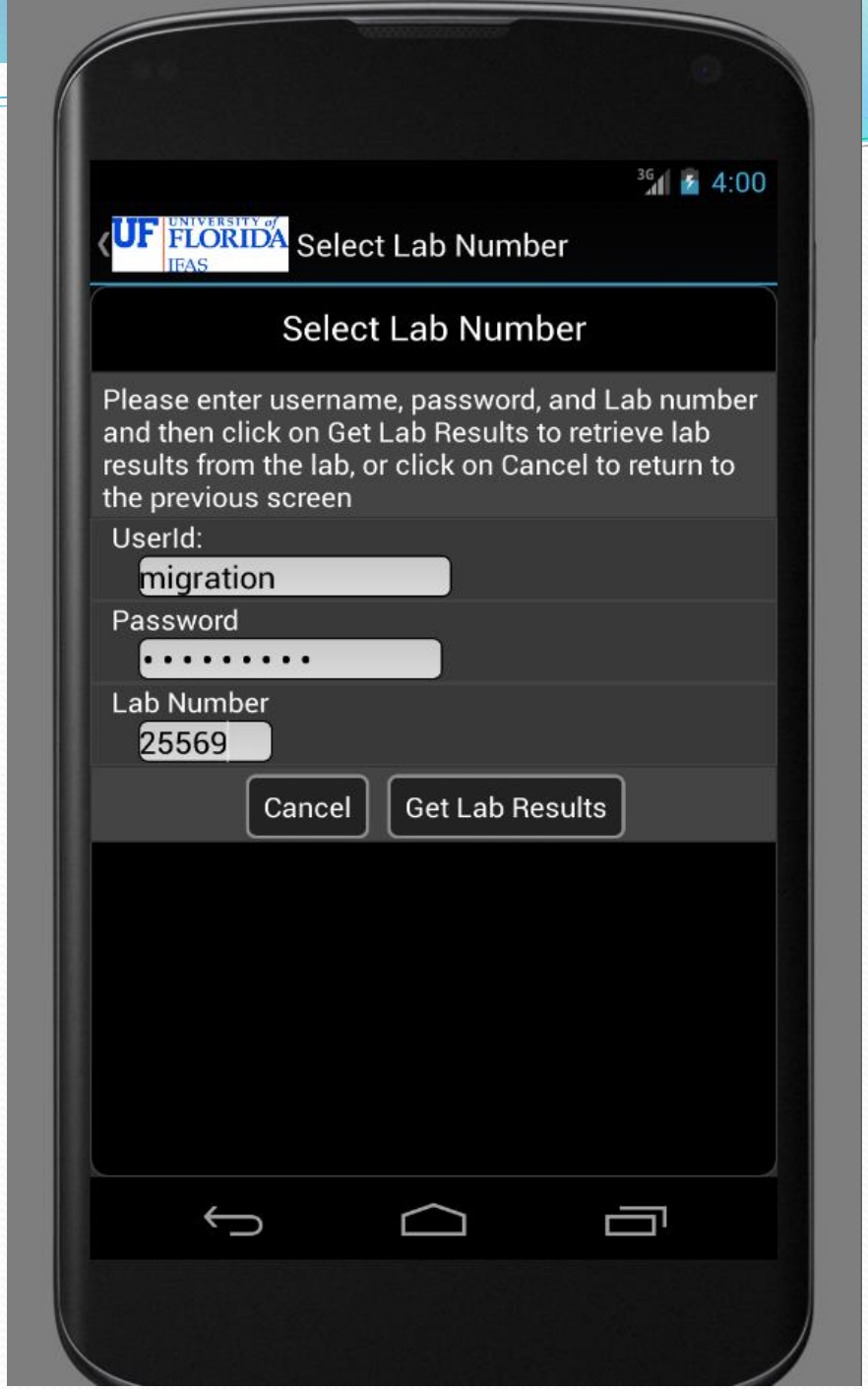
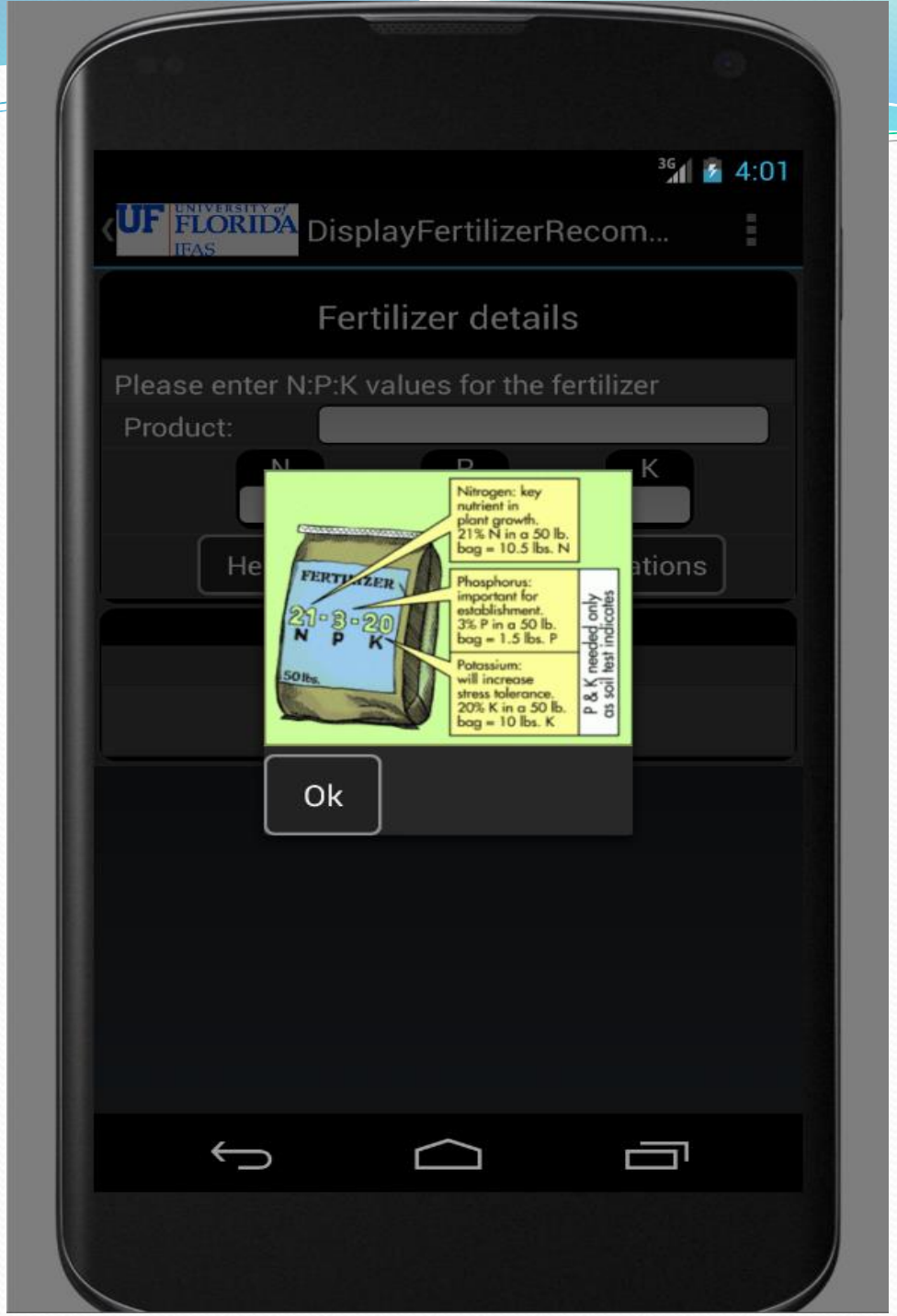
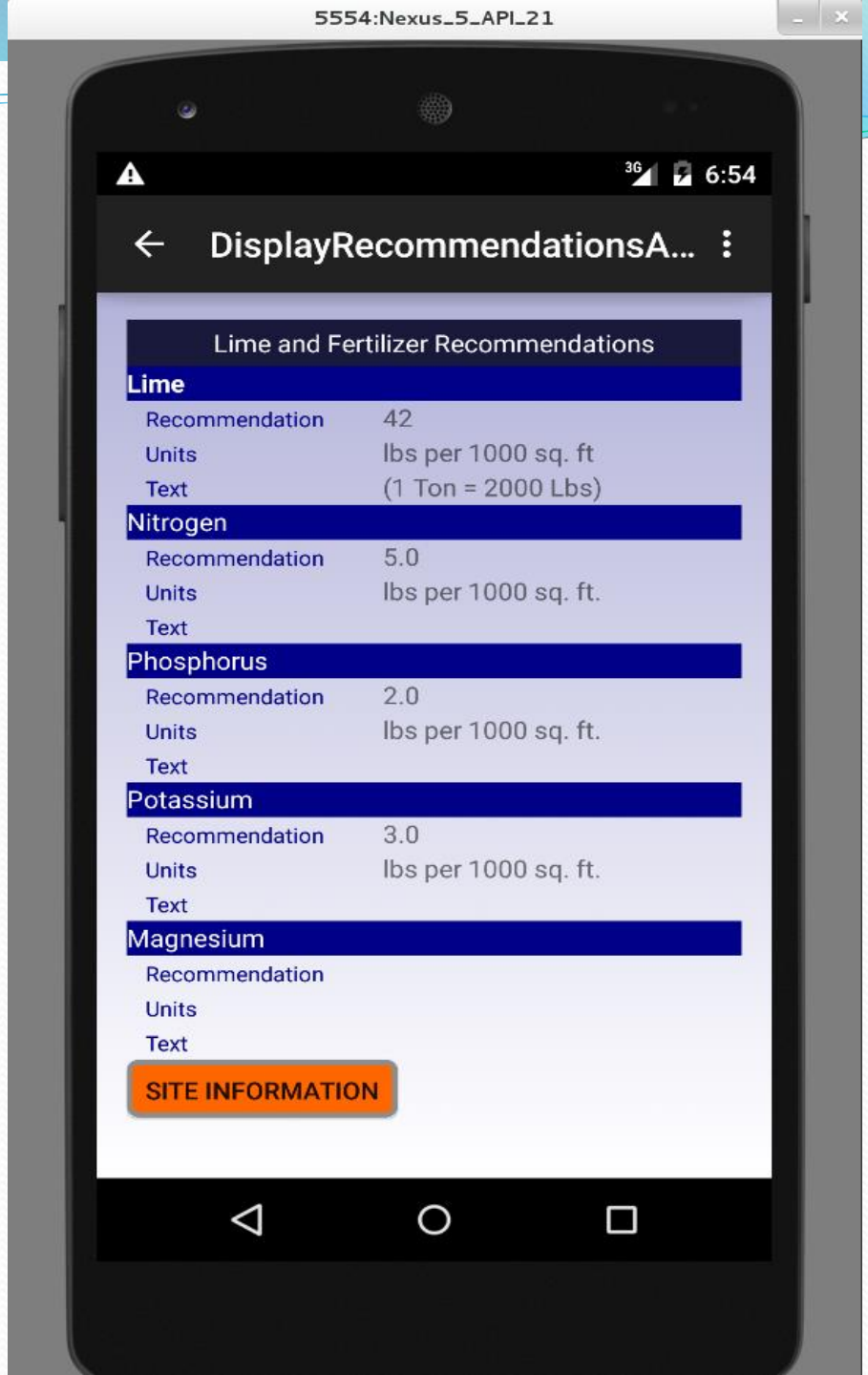
6:35
Landscape And Vegetable...
Lab Analysis Results
Crop:
St.Augustine grass
County:
Escambia
pH
5.8
bufferpH
7.62
Phosphorus(P_2O_5)
13
Potassium(K_2O)
20
Magnesium
61
Calcium
284
GET LAB RESULTS
GET RECOMMENDATIONS


4:00
UF UNIVERSITY of FLORIDA IFAS
Select Lab Number
Select Lab Number
Please enter username, password, and Lab number and then click on Get Lab Results to retrieve lab results from the lab, or click on Cancel to return to the previous screen
UserId:
migration
Password
Lab Number
25569
Cancel
Get Lab Results


4:01
UF UNIVERSITY of FLORIDA IFAS
DisplayFertilizerRecom...
Fertilizer details
Please enter N:P:K values for the fertilizer
Product:
N
P
K
Nitrogen: key nutrient in plant growth. 21% N in a 50 lb. bag = 10.5 lbs. N
Phosphorus: important for establishment. 3% P in a 50 lb. bag = 1.5 lbs. P
Potassium: will increase stress tolerance. 20% K in a 50 lb. bag = 10 lbs. K
P & K needed only as soil test indicates
FERTILIZER
21-3-20
N P K
50 lbs.
Ok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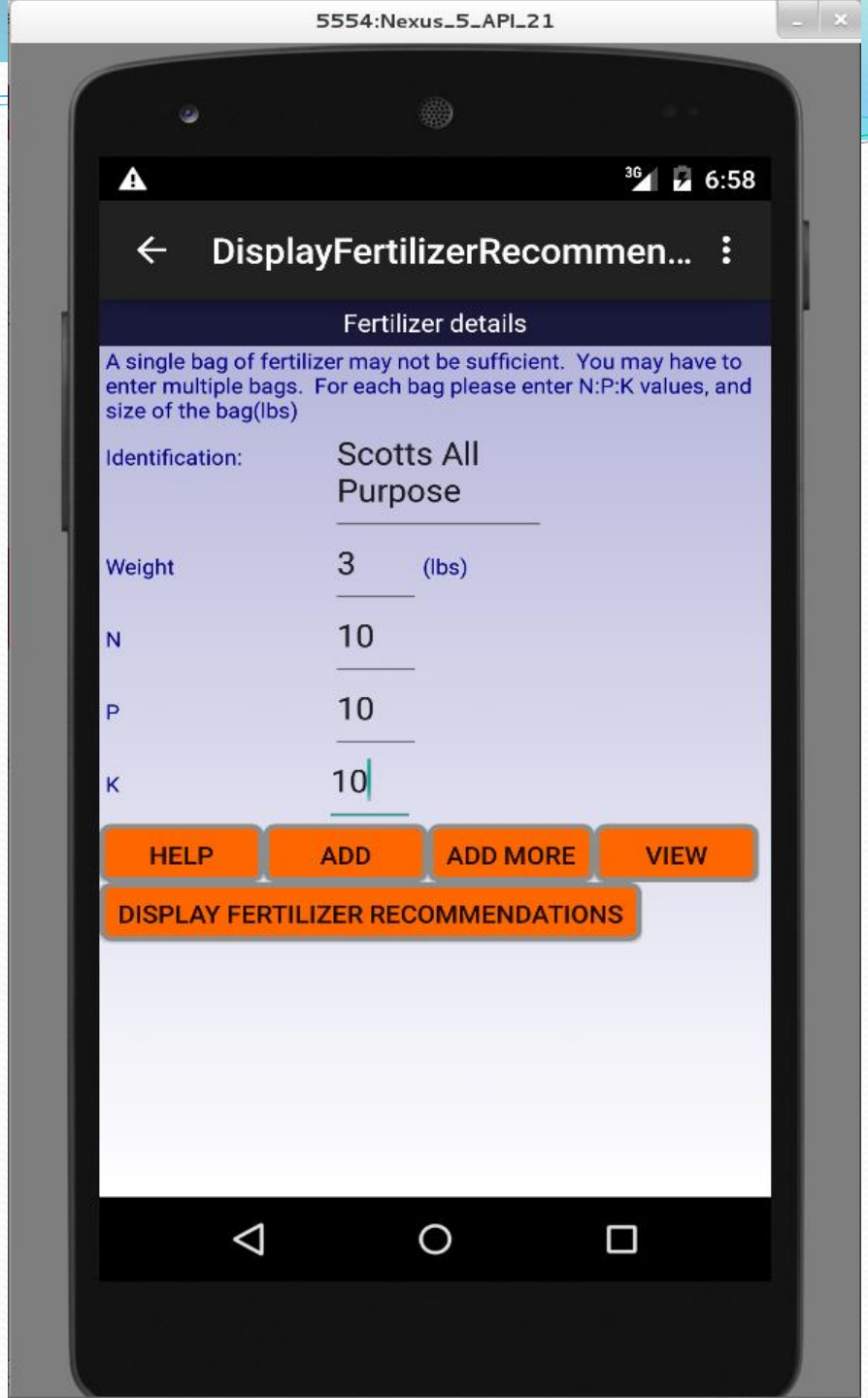
DisplayRecommendationsA...
Lime and Fertilizer Recommendations
Lime
Recommendation 42
Units lbs per 1000 sq. ft
Text (1 Ton = 2000 Lbs)
Nitrogen
Recommendation 5.0
Units lbs per 1000 sq. ft.
Text
Phosphorus
Recommendation 2.0
Units lbs per 1000 sq. ft.
Text
Potassium
Recommendation 3.0
Units lbs per 1000 sq. ft.
Text
Magnesium
Recommendation
Units
Text
SITE INFORMATION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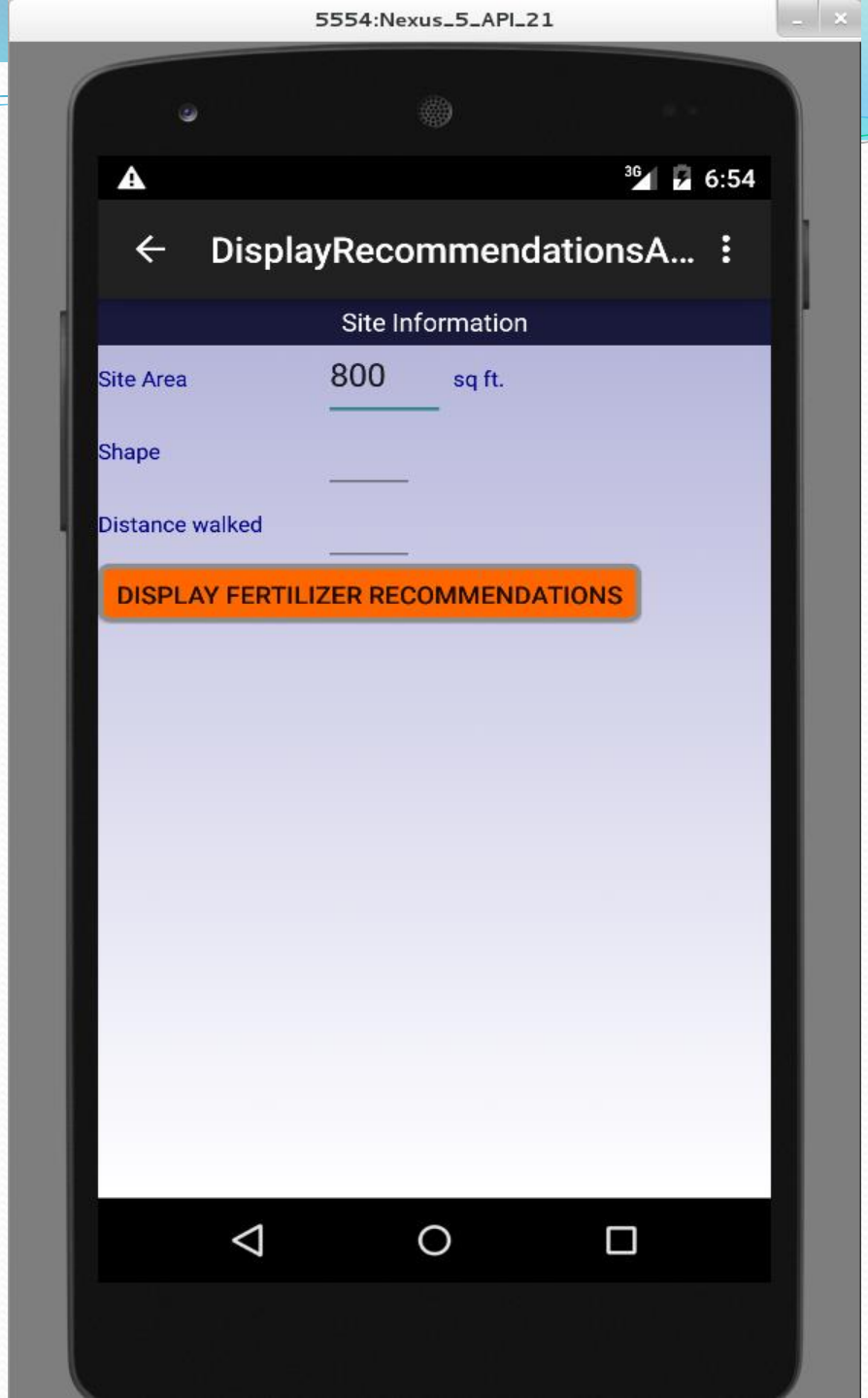
6:58
DisplayFertilizerRecommen...
Fertilizer details
A single bag of fertilizer may not be sufficient. You may have to enter multiple bags. For each bag please enter N:P:K values, and size of the bag(lbs)
Identification:
Scotts All Purpose
Weight
3
(lbs)
N
10
P
10
K
10
HELP
ADD
ADD MORE
VIEW
DISPLAY FERTILIZER RECOMMENDATIONS


5554:Nexus_5_API_21
6:54
DisplayRecommendationsA...
Site Information
Site Area
800
sq ft.
Shape
Distance walked
DISPLAY FERTILIZER RECOMMENDATIONS

UF/IFAS ESTL Procedures

UF/IFAS Extension Soil Testing Laboratory (ESTL) Analytical Procedures and Training Manual -CIRCULAR 1248 (2015)

-Mylavarapu, d'Angelo and Wilkinson

M-3 Extractant

- Mylavarapu, R., T.A. Obreza, K. Morgan, G. Hochmuth, V. Nair and A. Wright. 2014. Extraction of Soil Nutrients Using Mehlich-3 Reagent for Acid-Mineral Soils of Florida. SL407, Soil & Water Science, IFAS Cooperative Extension Service, University of Florida, Gainesville, FL 32611. pp7.

(http://edis.ifas.ufl.edu/ss620)

Nutrient Recommendations for Agronomic Crops

UF/IFAS Standardized Fertilization Recommendations for Agronomic Crops. Fact Sheet SL-129

-Mylavarapu, R., D. Wright, G. Kidder and C. Chambliss (2015)

IFAS Extension Publications can be obtained from

http://edis.ifas.ufl.edu

On the Web –

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SOILSLAB@ifas.ufl.edu

raom@ufl.edu