



# UGA Ag & Environmental Services Lab



**Jay Lessl, Ph.D.**  
**Program Coordinator**  
**AOOPA & GOGA Meeting 2019**

# Our Mission



College of Agricultural &  
Environmental Sciences  
UNIVERSITY OF GEORGIA

- To provide objective analytical services to agricultural producers, consumers, and agribusinesses
- Unbiased interpretations and recommendations which contribute to a competitive agricultural industry, a healthy environment and an improved quality of life



# UGA – AESL annual samples

- ❑ Soil - 64,420
- ❑ Plant – 4,810
- ❑ Animal Feed – 8,100
- ❑ Water - 8,570
- ❑ Microbiology – 2,757
- ❑ Manure - 1,600
- ❑ Fertilizer/Biosolids - 1,640
- ❑ Pesticide/Quality – 2,200
- ❑ **Total: 94,097 samples**





# External Audits, Proficiency and Certification

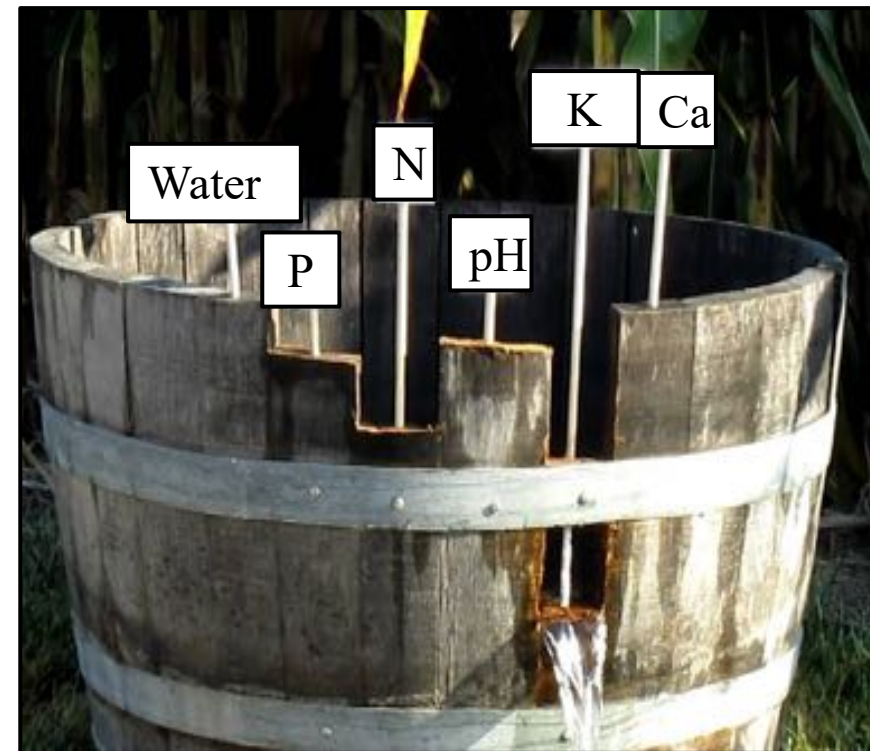
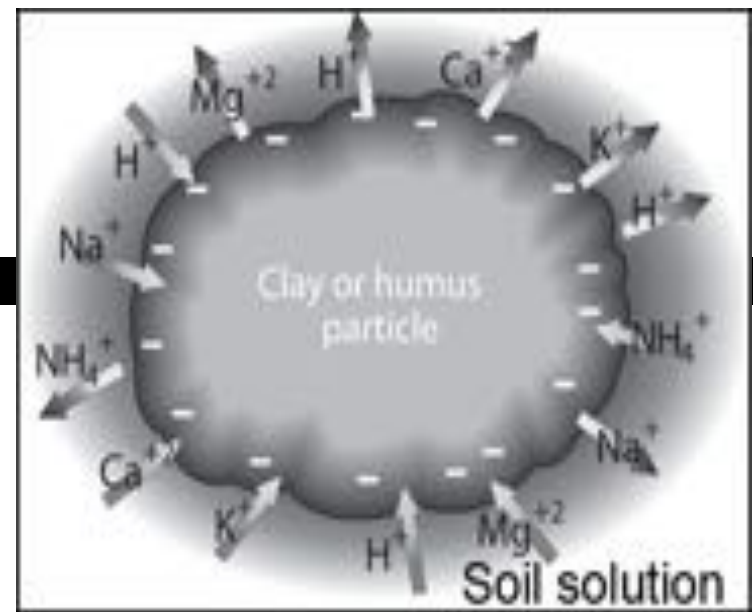


- ❑ Assoc. of American Feed Control Officials (AAFCO)
- ❑ Env. Resource Associates (ERA): Coliform and *E. coli*
- ❑ MN Dept. of Agriculture Manure Analysis Proficiency
- ❑ National Forage Testing Association (NFTA)
- ❑ Agricultural Laboratory Proficiency Program (ALP)
- ❑ NSI Solutions, Inc.
- ❑ State of Georgia EPD (EPD): Drinking water microbiology

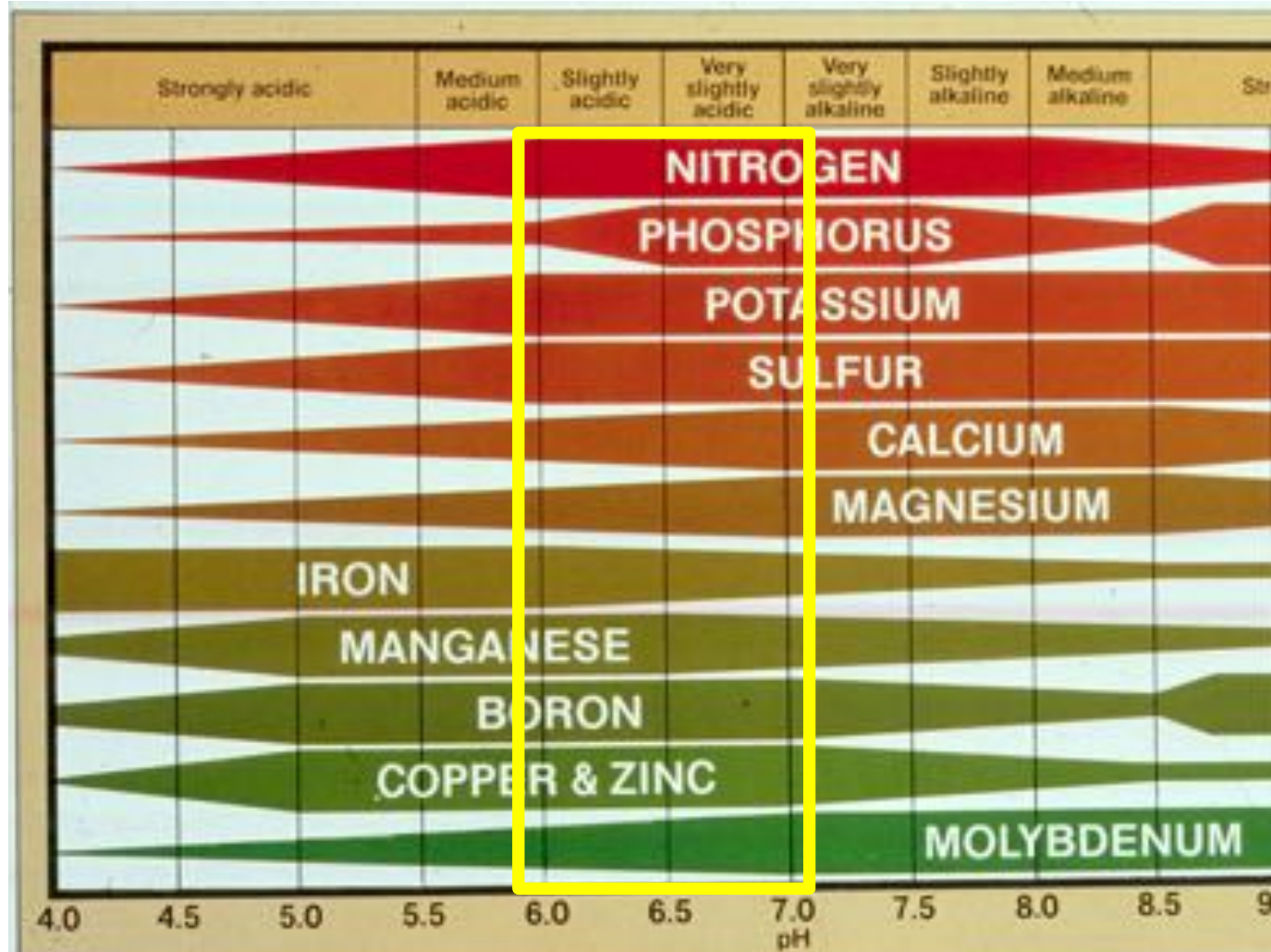


# Soil Testing

- Why soil test?
  - ▣ Soil testing is an important diagnostic tool to evaluate nutrient imbalances and understand plant growth
- Basis for intelligent application of fertilizer and lime
  - ▣ Maintain soil pH in optimum range, which keeps nutrients more available to the plant
- Protection of environment
  - ▣ Pollute our surface and ground waters by indiscriminate application of fertilizers
- Cost savings
  - ▣ Why apply what you don't need?

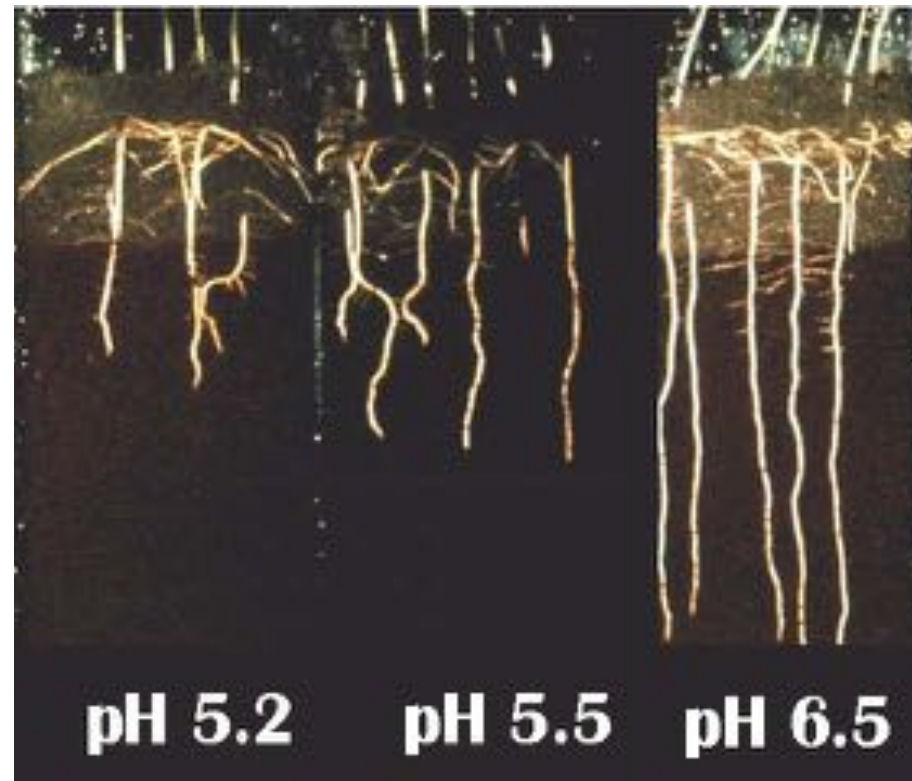


# Soil pH & Nutrients



# Soil pH

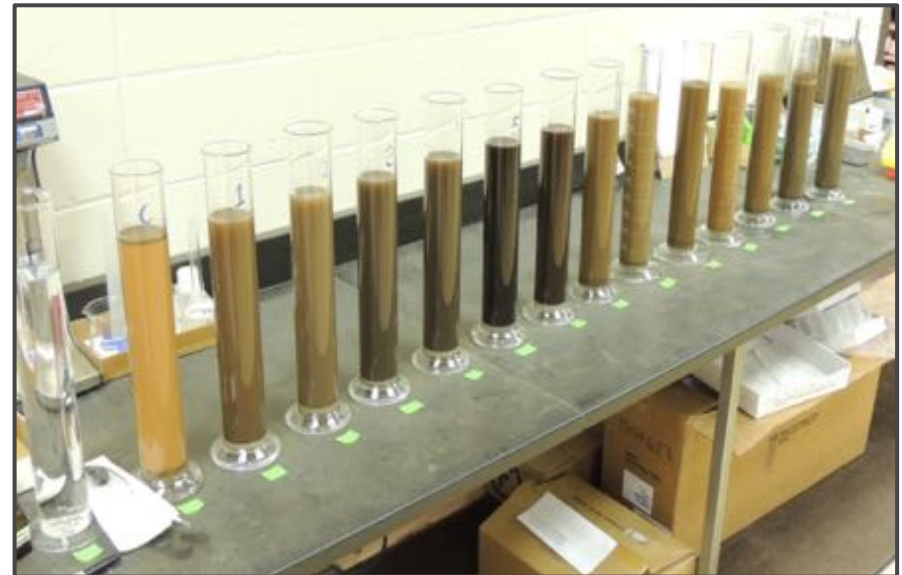
- ❑ Crop dependent
  - ▣ Olives: 6.0-7.0
  - ▣ Corn, Soybean: 6.5
  - ▣ Vegetable Garden: 6.0-6.5
  - ▣ Bermuda, Fescue: 5.5-6.5
  - ▣ Blueberry: 4.5-5.0
- ❑ Georgia soils are acidic, ~5.0
- ❑ Less than 5.5 can lead to aluminum toxicity & reduced root growth
- ❑ Sources of acidity
  - ▣ Fertilizer, Natural





# Soil Analysis

- ❑ Routine Soil Test
  - ▣ S1; pH, LBC, P, K, Ca, Mg, Zn, Mn
  - ▣ S2; CEC, Base Saturation, Na, Fe, Cu, Cr, Mo, Ni, Cd
- ❑ S3; Boron
- ❑ S4; Electrical conductivity
- ❑ S5; Texture
- ❑ S6; Organic Matter
- ❑ S7; Nitrate-nitrogen
- ❑ S8; Ammonium-nitrogen
- ❑ S13; Total Elemental Analysis
- ❑ Many others...






# Taking a Sample

- Delineate areas
  - ▣ The more the better
    - 1 sample should not >10 acres
  - ▣ Sample in between trees avoiding areas where fertilizer is directly applied
  - ▣ Problem areas should be sampled separately
- Avoid sampling in unrepresentative areas
  - ▣ Crops - each year



**SOIL SAMPLE BAG**

  
The University of Georgia

Soil, Plant, and Water Laboratory  
2400 College Station Road  
Athens, Georgia 30602

Check Tests Requested - Submit Fee With Sample

☐ ROUTINE TEST: pH, P, K, Ca, Mg, Zn, Mn, Li.

☐ Boron ☐ Organic Matter

☐ Soluble Salts ☐ Nitrate

☐ Greenhouse/Nursery Test: Artificial Mixes Only

**-----FILL TO THIS LINE-----**

NAME \_\_\_\_\_

ADDRESS \_\_\_\_\_

CITY \_\_\_\_\_

ZIP CODE \_\_\_\_\_

CROP \_\_\_\_\_

# Soil Fertility Report Example - Olive



Ag & Environmental Services Labs

Soil, Plant, and Water Laboratory  
2400 College Station Road  
Athens, Georgia 30602-9105  
Website: <http://aesl.ces.uga.edu>

## Soil Test Report

### Sample ID

(CEC/CEA Signature)

<b>Client Information</b> Schmidt, Jason Entomology 126 Annex Tifton, GA 31793 Sample: Veg Park 1 Crop: Olives	jschmidt@uga.edu 229-386-7251	<b>Lab Information</b> Lab #999 Completed: Jul 8, 2015 Printed: Feb 9, 2019	<b>County Information</b> Lanier County 162 W. Thigpen Ave Lakeland, GA 31635 phone: 229-482-3895 e-mail: uge4173@uga.edu
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### Results

Mehlich I Extractant

UGA Lime Buffer Capacity Method\*

	Very High			
	High			
	Medium			
	Low			
	Phosphorus (P)	Potassium (K)	Calcium (Ca)	Magnesium (Mg)
Soil Test Index	54 lbs/Acre	59 lbs/Acre	950 lbs/Acre	120 lbs/Acre

High				
Sufficient				
Low				
Zinc (Zn)	Manganese (Mn)	pH *	Lime Buffer Capacity (LBC)	
5 lbs/Acre	12 lbs/Acre	5.0	200	Soil Test Index

### Recommendations

Can't find a specific grade of fertilizer? Try our Fertilizer Calculator: <http://aesl.ces.uga.edu/soil/fertcalc/>

Limestone	Nitrogen (N)	Phosphate (P <sub>2</sub> O <sub>5</sub> )	Potash (K <sub>2</sub> O)	Sulfur (S)	Boron (B)	Manganese (Mn)	Zinc (Zn)
2.25 tons/Acre	80-100 lbs/Acre	30 lbs/Acre	80 lbs/Acre	--	--	--	--

Recommended pH: 6.0 to 7.0

# Plant Tissue Analysis

- P1; Basic Test
- P4; Total N only
- Sampling Guide
  - ▣ Young mature leaves
  - ▣ During growth extension
  - ▣ 1-2 leaves from >20 trees
  - ▣ Exclude pollinators or abnormal trees

**Send in Paper Bags**



# Plant Tissue Report - Olive



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Ag & Environmental Services Labs

Soil, Plant, and Water Laboratory  
2400 College Station Road  
Athens, Georgia 30602-9105  
Website: <http://aesl.ces.uga.edu>

## Plant Analysis Report

(CEC/CEA Signature)

### Sample ID

#### Client Information

**Doe, John**  
1234 First Street  
Dade City, FL 33523  
Sample: Block II  
Crop: Olive

[jlessl@uga.edu](mailto:jlessl@uga.edu)  
706-542-5350

#### Lab Information

Lab #31  
Received: Jul 6, 2018  
Completed: Jul 12, 2018  
Printed: Feb 9, 2019  
Tests: P1

#### Contact

**Soil, Plant, and Water Laboratory**  
2400 College Station Road  
Athens, GA 30602  
ph: 706-542-5350  
e-mail: [soiltest@uga.edu](mailto:soiltest@uga.edu)

### Percentage (%)

### Parts Per Million (ppm)

Nitrogen (N)	Phosphorus (P)	Potassium (K)	Calcium (Ca)	Magnesium (Mg)	Sulfur (S)	Manganese (Mn)	Iron (Fe)	Aluminum (Al)	Boron (B)	Copper (Cu)	Zinc (Zn)	Nickel (Ni)
1.81	0.66	1.77	1.06	0.14	0.26	24	52	33	24	8	30	<1

Sufficiency ranges:

1.50-2.00	0.10-0.30	0.80-1.20	1.00-2.00	0.10-0.30	0.10-0.25	20-100	unknown	unknown	20-75	5-10	20-50	unknown
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# Crop Quality Laboratory



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- Started in 2013 to provide analytical support for specialty crops in Georgia
  - Ensure Quality
  - Support Research



# Crop Quality Laboratory



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- Developed basic olive oil analysis procedures
- Mentor student projects that compared quality of Georgia's olive oil to other premium oils
- Participating in the American Oil Chemistry Society (AOCS) laboratory proficiency program since 2015
- Measure impact of pruning on olive quality
- Develop oil and moisture NIR calibration specific to SE region

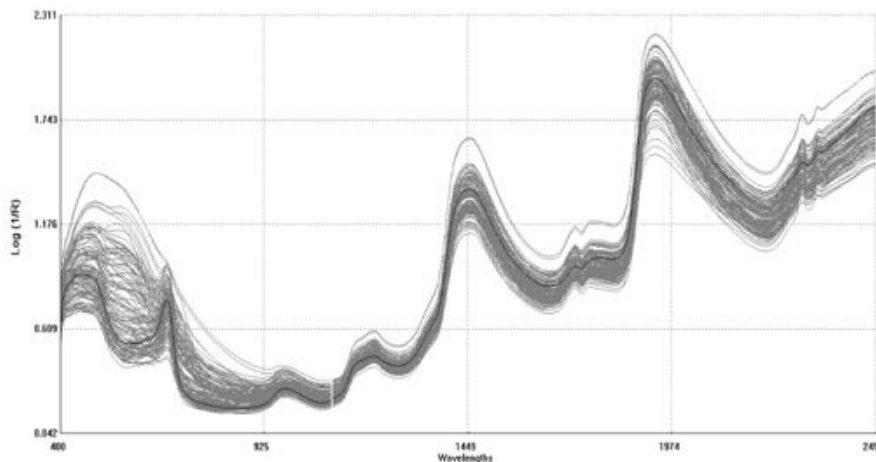


# NIR Calibration



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- Near Infra-red Spectroscopy to determine olive moisture and oil content
- Olives collected from the Georgia and Florida
  - ▣ 30 samples in 2015
  - ▣ 128 samples in 2016
  - ▣ FOSS XDS NIR system



# NIR Calibration



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- Benefits for testing olives
  - ▣ Turnaround time 1 day vs. 5-7 days
  - ▣ Cost \$20 vs \$80+
  - ▣ Accurate

- Information

- ▣ %Moisture
  - ▣ %Oil
  - ▣ 9 fatty acids

		ANALYTICAL RESULTS		
LAB ID #	Sample Date	Oil		Moisture
		Dry Weight, %	Fresh Weight, %	%
CEQ 154	9/2/2018	26.81	10.22	37.81
Typical Ranges:		10 - 45	5 - 22	40 - 60

\*Ideal time to harvest olives is when oil content stops increasing and moisture content is around 50%

Additional Parameters	Results	Normal Ranges		
Fresh Oil content, g/kg	102.2	50-220*		
Palmitic, %	19.0	7.5-20%		
Stearic, %	1.5	0.5-5%		
Oleic, %	60.6	55-83%		
Linoleic, %	14.3	3.5-21%		
Linolenic, %	1.0	<1.5%		

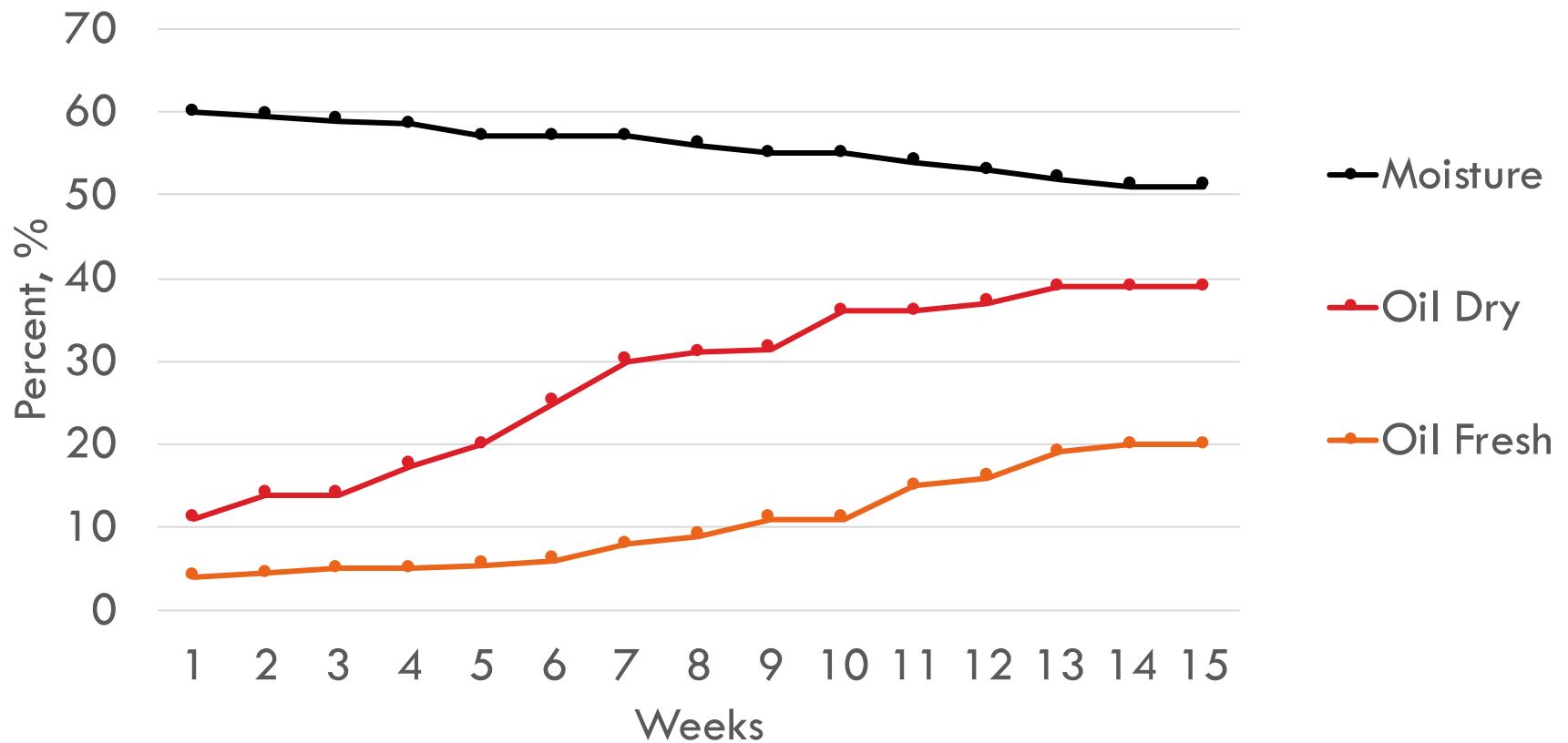


# NIR Calibration



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## Fruit Oil and Moisture Levels



# Crop Quality Laboratory



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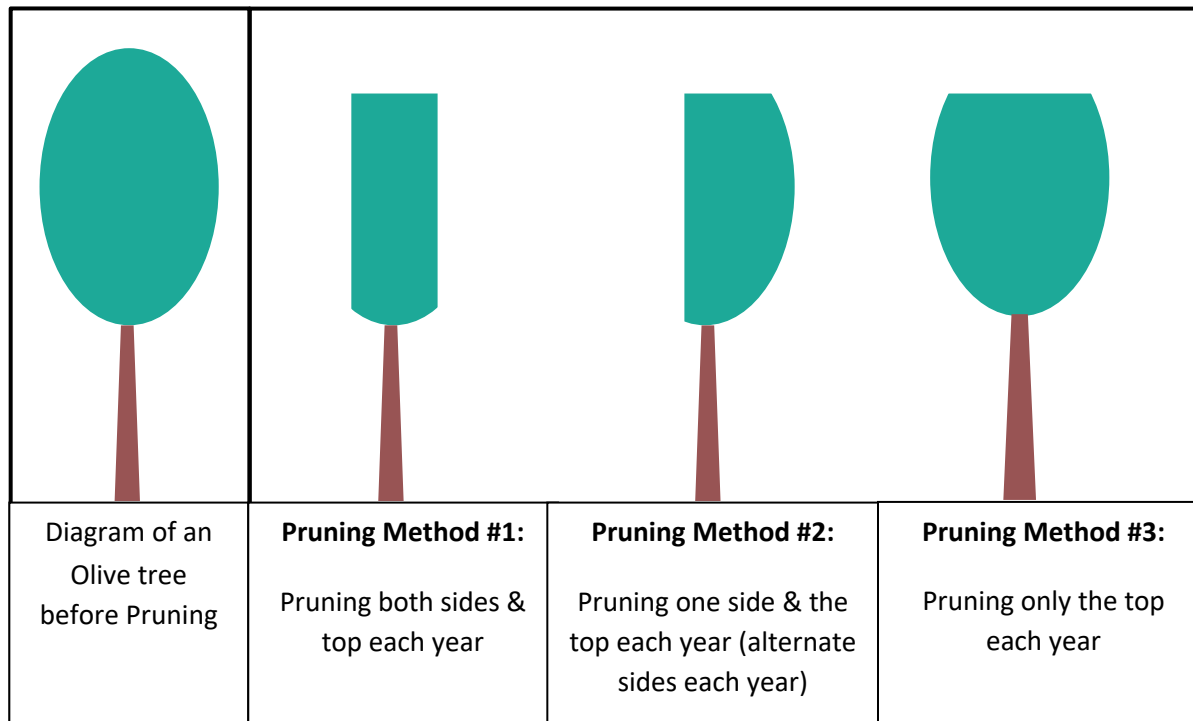
Test No.	Description	Fee (\$)
C8	Percent Moisture & Oil (NIR)	20.00
C9	Peroxide Value (PV)	30.00
C10	Free Fatty Acid Content (FFA)	30.00
C11	Specific Extinction, Ultraviolet Absorption (UV)	45.00
C12	Fatty Acid Profile (FAP)	60.00
C13	Oil Quality (PV, FFA, UV, FAP) for extra virgin status	125.00

# Pruning Study



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- Both sides of the tree/hedgerow in two year rotation with annual top pruning. (Green Post)
- Both sides of the tree/hedgerow in three year rotation with annual top pruning. (Red Post)
- Alternating halves of the tree every year with annual top pruning. (White Post)



# Pruning Study

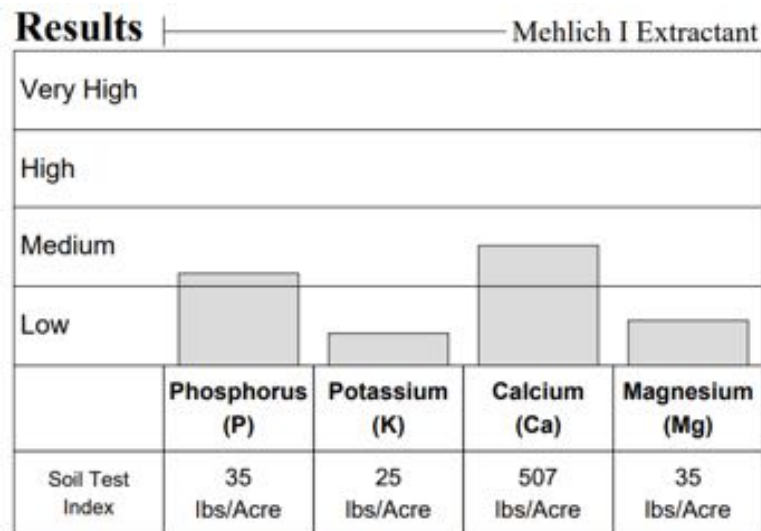




# Plant & Soil Results 2018



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Percentage					Parts Per Million (ppm)					
Nitrogen	Phosphorus	Potassium	Calcium	Magnesium	Sulfur	Manganese	Iron	Boron	Copper	Zinc
(N)	(P)	(K)	(Ca)	(Mg)	(S)	(Mn)	(Fe)	(B)	(Cu)	(Zn)
1.39	0.34	1.49	1.04	0.10	0.16	23	42	24	8	30
Sufficiency ranges:										
1.50 - 2.00	0.10 - 0.30	0.80 - 1.20	1.00 - 2.00	0.10 - 0.30	0.10 - 0.25	20 - 100	35-66	20 - 75	5 - 10	20 - 50

# Olive Oil Results



Location	Treatment	FFA (% Oleic)	Peroxides (meq/kg oil)	232	270	Delta K
AR	Green	0.15	2.12	1.55	0.12	0.02
AR	White	0.17	3.17	1.49	0.12	0.01
AR	Red	0.20	3.33	1.57	0.12	-0.02
Mill	Green	0.20	1.78	1.49	0.11	0.00
Mill	White	0.16	1.66	1.49	0.11	-0.01
Mill	Red	0.14	1.68	1.52	0.13	-0.02

Test	IOC/USDA Standard for Extra Virgin Olive Oil
Free Fatty Acid, %	≤0.8
Peroxide Value, meq/kg	≤20
K232	≤2.50
K270	≤0.22
Delta K	≤0.01

# Olive Oil FFA



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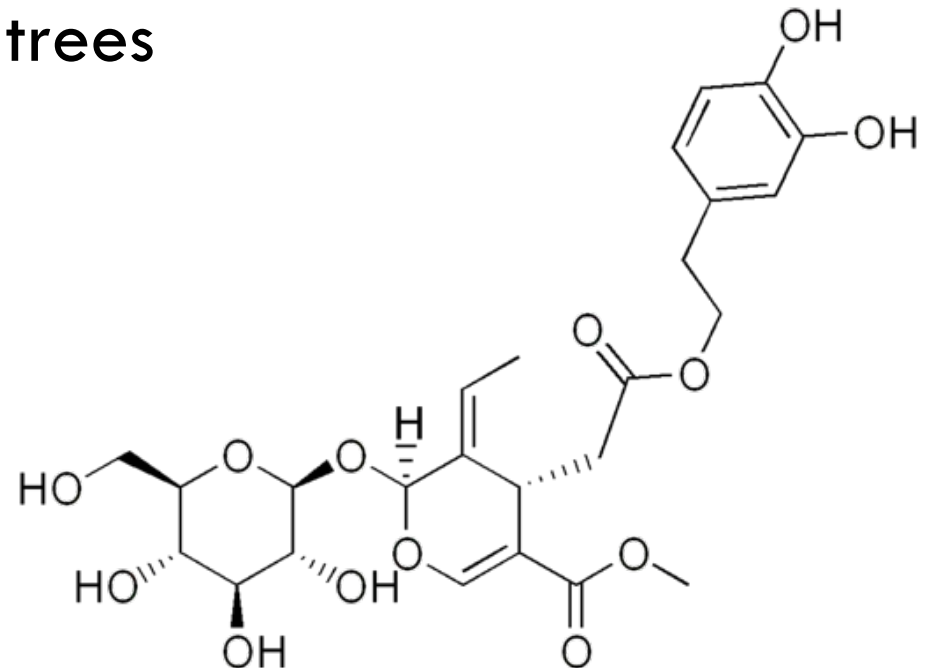
Fatty Acid	Carbon	Result	Range
Palmitic	C16:0	19.21	7.5 - 20.0
Palmitoleic	C16:1	3.67	0.3 - 3.5
Heptadecanoic	C17:0	0.06	< 0.50
Heptadecenoic	C17:1	0.18	< 0.60
Stearic	C18:0	1.68	0.5 - 5.0
Oleic	C18:1	59.05	55.0 - 83.0
Linoleic	C18:2	14.85	3.50 - 21.0
Linolenic	C18:3	0.64	< 1.50
Arachidic	C20:0	0.30	< 0.80
Behenic	C22:0	0.20	<0.30
Lignoceric	C24:0	0.09	< 1.0

# Looking to the future



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- Continue monitoring pruning
- Airflow and pollination
  - ▣ Monitor movement of pollen and treat rows with fans
- Alternative uses of olive trees
  - ▣ Olive leaf extracts
  - ▣ Oleuropein





# Additional Information



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- AESL website - <http://aesi.ces.uga.edu>
  - ▣ [aesi.ces.uga.edu/FeeSchedule](http://aesi.ces.uga.edu/FeeSchedule)
- Fertilization Calculator
  - ▣ <http://aesi.ces.uga.edu/soil/fertcalc>
- Drinking Water Interpretation and Recommendations
  - ▣ <http://aesi.ces.uga.edu/water/recommendations>
- Soil Publications
  - ▣ <http://aesi.ces.uga.edu/publications/soilcirc>
    - Organic fertilizer
    - Nitrogen mineralization
    - Soil testing
    - Lime requirements
    - Soil pH
    - Plant Tissue sampling



# Thank You!



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