Olive Orchard Nutrition & Fertilization

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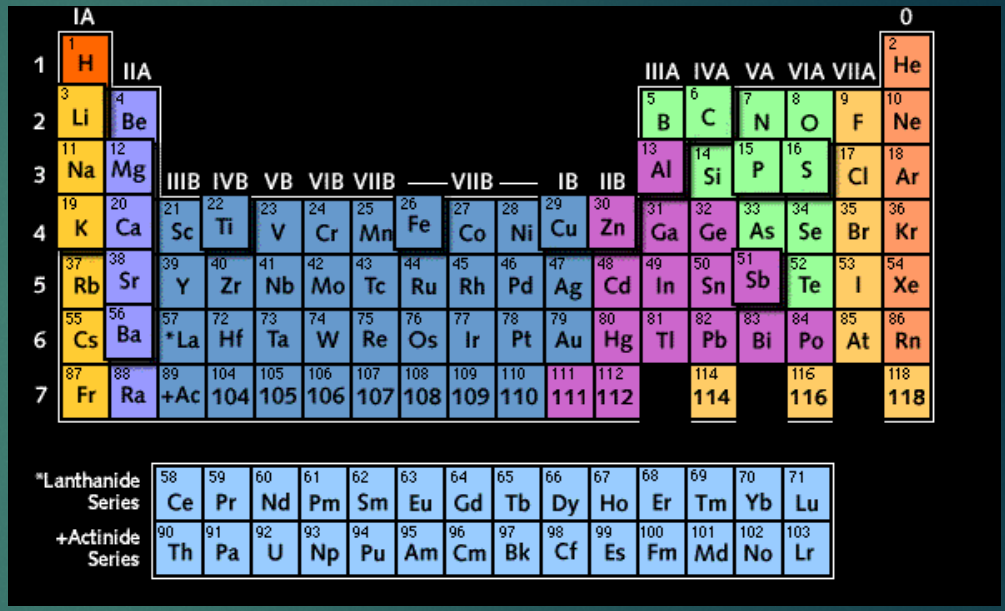
The Essential Elements

Macronutrients

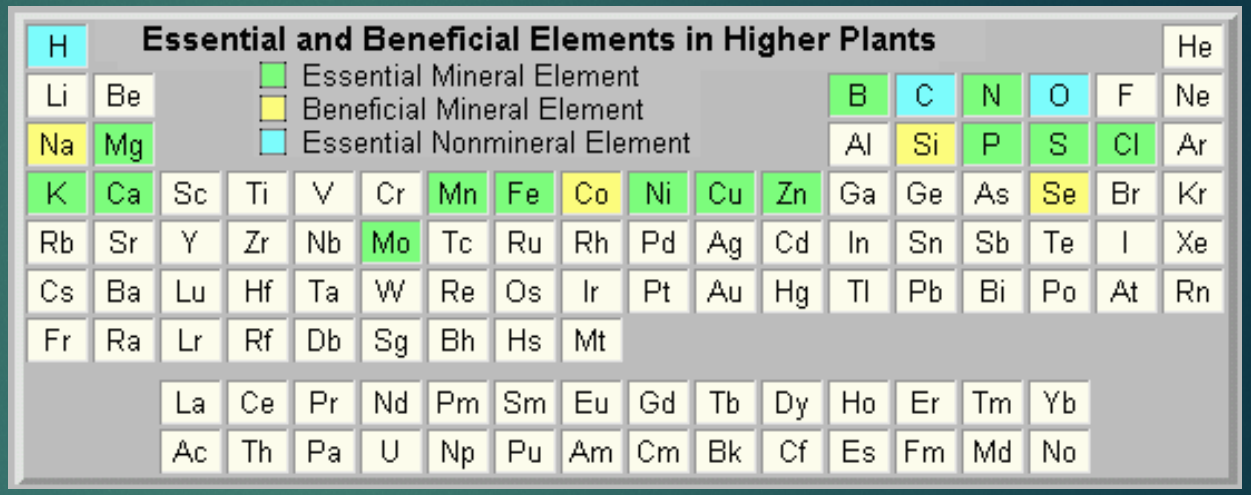
- Carbon CO_2
- Hydrogen H_2O
- Oxygen H_2O, O_2
- Phosphorus
- Potassium
- Nitrogen
- Sulfur
- Calcium
- Iron
- Magnesium



The Essential Elements

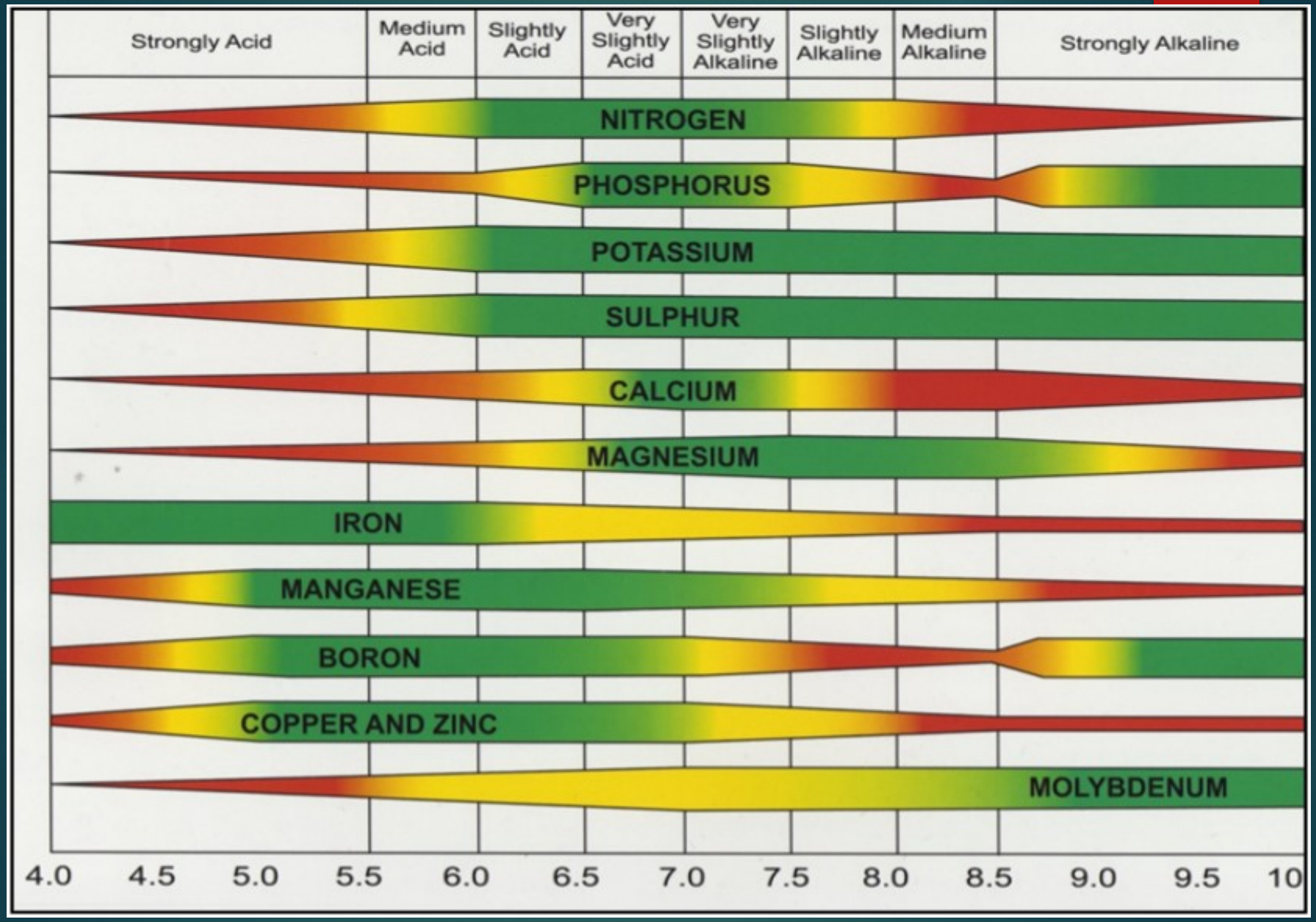
Mcronutrients

- Boron
- Zinc
- Manganese
- Copper
- Molybdenum
- Chlorine



A Soil Sample….

- **Will Tell You**
  - **Soil pH**
  - **Soil Nutrient Composition**
- **Will Not Tell You**
  - **Soil Depth**
  - **Soil Drainage**
  - **Presence of Soil Borne Pathogens**
  - **Presence of Residual Chemicals**
  - **Suitability to Grow Olives**


Strongly Acid
Medium Acid
Slightly Acid
Very Slightly Acid
Very Slightly Alkaline
Slightly Alkaline
Medium Alkaline
Strongly Alkaline
NITROGEN
PHOSPHORUS
POTASSIUM
SULPHUR
CALCIUM
MAGNESIUM
IRON
MANGANESE
BORON
COPPER AND ZINC
MOLYBDENUM
4.0
4.5
5.0
5.5
6.0
6.5
7.0
7.5
8.0
8.5
9.0
9.5
10

Nitrogen

SOIL TEST REPORT PAGE 1

TEXAS AGRICULTURAL EXTENSION SERVICE -- THE TEXAS A & M UNIVERSITY SYSTEM
SOIL TESTING LABORATORY, COLLEGE STATION TX. 77843

DR. TONY PROVIN
LAB DIRECTOR (409)845-4816

INV# [redacted]
FOR: [redacted]
FREDERICKSBURG, TX
78624
FEE : $10.00

DATE RECEIVED : 1/17/03
DATE PROCESSED: 01/22/03
COUNTY : GILLESPIE
COUNTY#: 171
LAB # : 88185

|SAMPLE ID# #1

SOIL ANALYSIS

|SOIL TEST RATINGS - PPM ELEMENT (AVAILABLE FORM)|

PH ACIDIT	NITRATE-N	HOSPHO-RUS	POTASSIUM	CALCIUM	MAGNESIUM	SALINITY	ZINC	IRON	MANGANESE	COPPER	SODIUM	SULPHUR	
7.[illegible] MILDLY ALKALI[illegible]	4. VERY LOW	48. HIGH	411. VERY HIGH	49072 VERY HIGH	847. HIGH	289. NONE					232. LOW	54 HIGH	

(PPM X 2 = LBS/ACRE 6 INCHES DEEP)

CROP AND YIELD RANGE: MINIMUM REQUIREMENT: WARM SEASON PERENNIAL GRASS

SUGGESTED FERTILIZER RATE LBS/A: 30 - 0 - 0

N P205 K20

APPLY PREPLANT.
MINIMUM REQUIREMENTS FOR ESTABLISHING VEGATATIVE CONSERVATION COVER.

FURTHER INFORMATION AND ASSISTANCE CAN BE OBTAINED FROM YOUR COUNTY EXTENSION AGENT :
BILL BOTARD
95 FREDERICK RD FREDERICKSBURG TX. 78624

Nutrient Mobility in Plants

Mobile	Non-Mobile	Partially Mobile
Nitrogen	Calcium	Sulfur
Phosphorus	Iron	Manganese
Potassium	Zinc	Copper
Magnesium	Molybdenum	
	Chlorine	

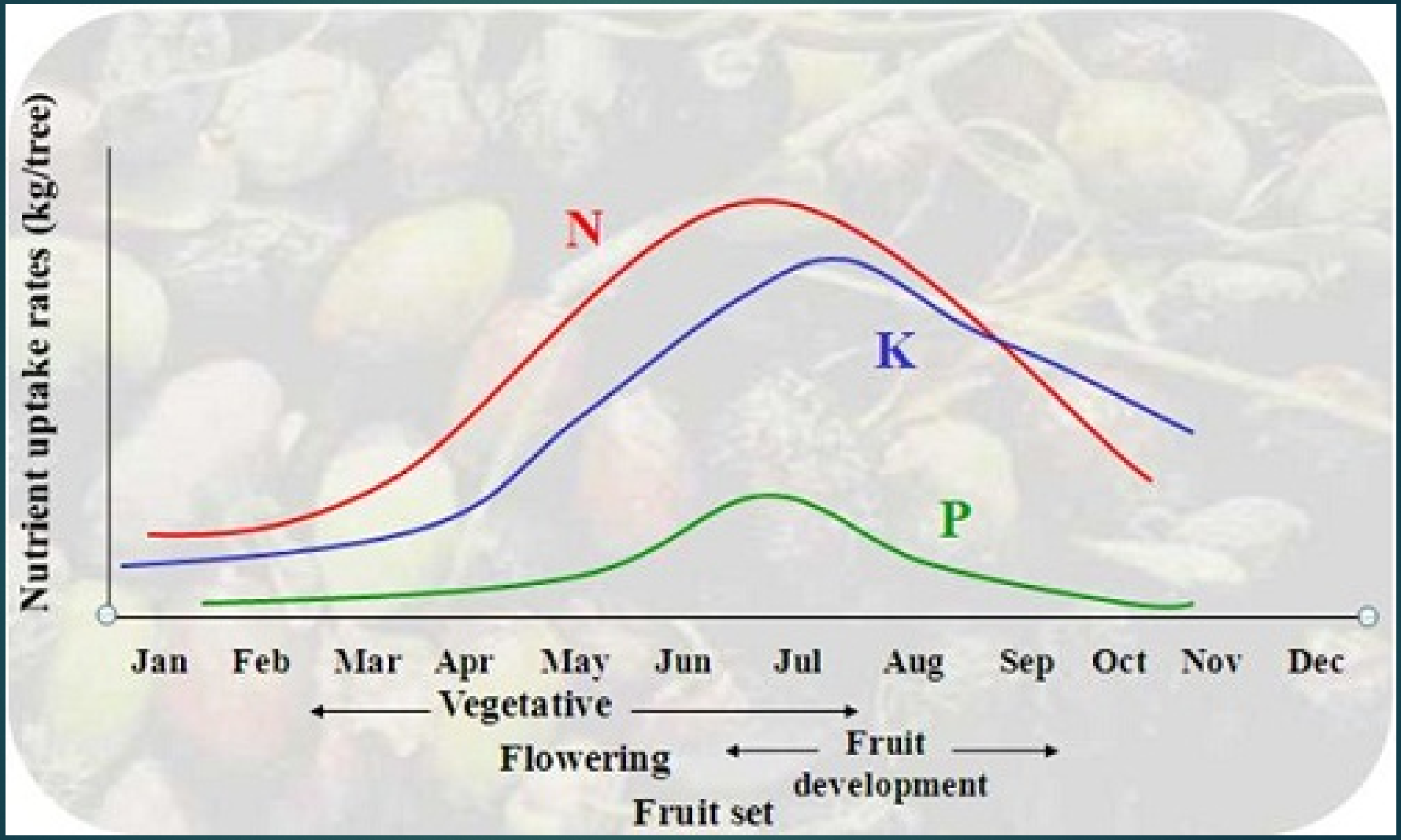
Nitrogen Deficiency

Zinc Deficiency

Nutrient Removal Rates in Pounds per Acre – Mature Orchard

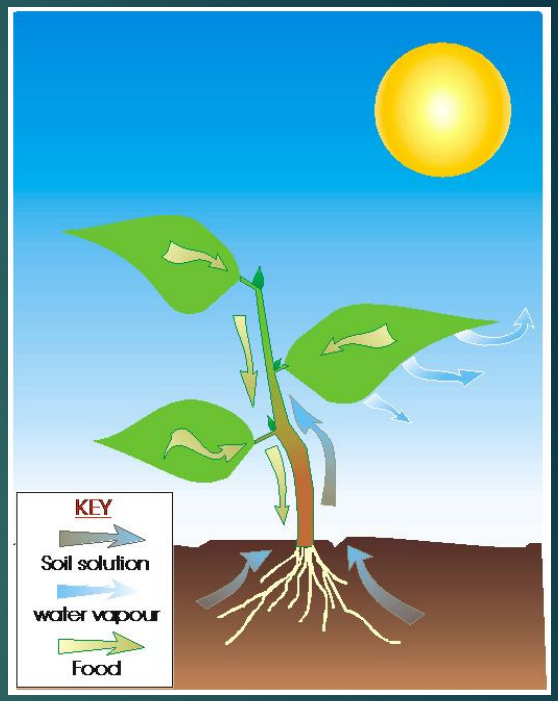
	Yield in Tons / Acre	N	P2O5	K2O	Mg	S
Olives	9	130	31	157	18	15

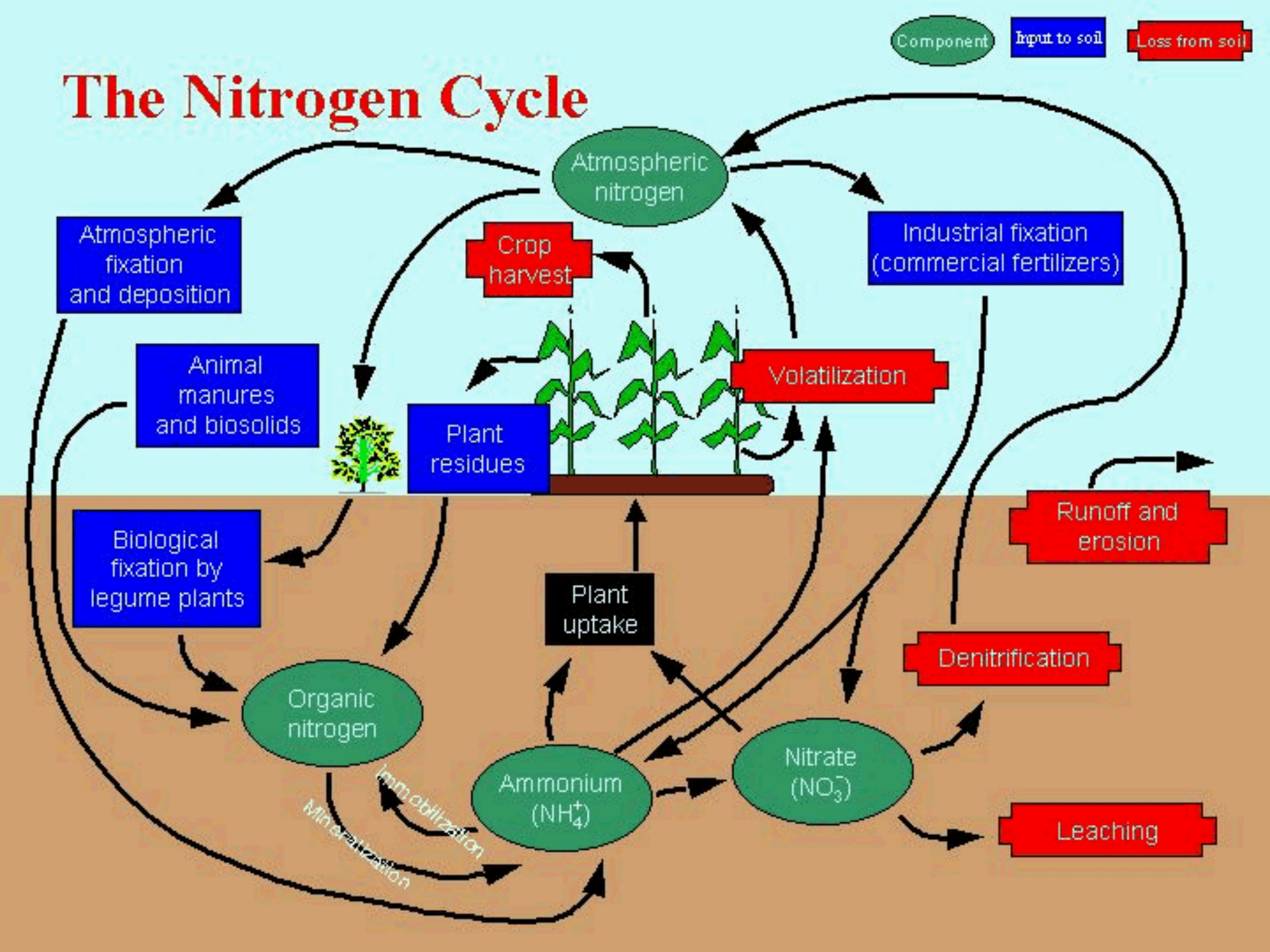
Seasonal Nutrient Requirements of Olive Trees



Critical Characteristics of Nitrogen

- Very Mobile in Soils (neg. charge)
- Very Mobile in Plants
- Soils Typically Very Low in Nitrogen
- Native Nitrogen in Soils Consists of:
  - Complex, Insoluble Unavailable Organic Compounds
  - Simple, More Soluble, Available Compounds in Soil Solution

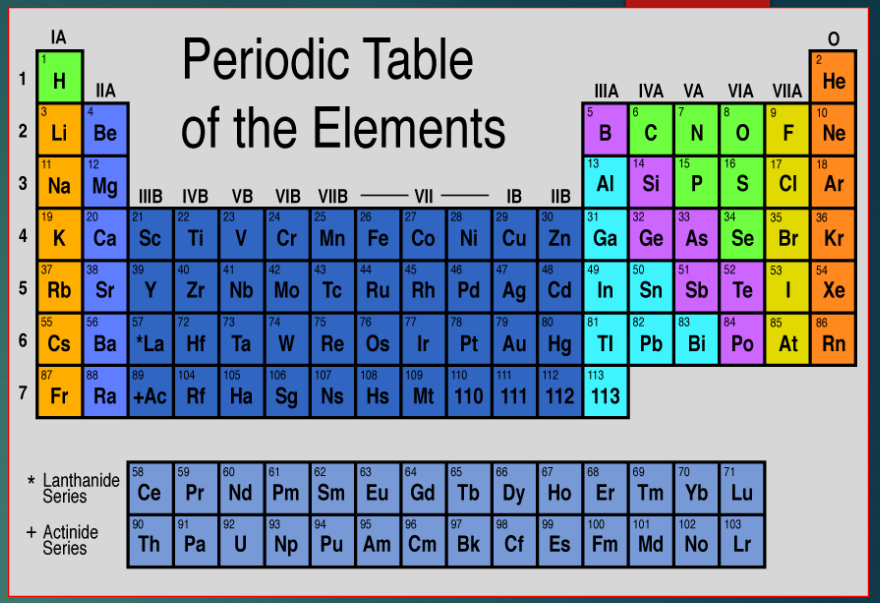



Component
Input to soil
Loss from soil
The Nitrogen Cycle
Atmospheric nitrogen
Atmospheric fixation and deposition
Industrial fixation (commercial fertilizers)
Crop harvest
Animal manures and biosolids
Volatilization
Plant residues
Runoff and erosion
Biological fixation by legume plants
Plant uptake
Denitrification
Organic nitrogen
Ammonium (NH_4^+)
Nitrate (NO_3^-)
Immobilization
Mineralization
Leaching

Key to Nitrogen Management

- **Promote Growth Early in the Season**
- **Maintain Healthy Canopy**
- **Small, Frequent Applications Most Economical**
- **Use Caution on Young Trees**
- **Foliar Applications May Have Value Post-Harvest**

What is a "Unit" of Nitrogen?



- A "Unit" is One Pound of Actual Nitrogen
- Based on Atomic Weight of Molecule
- Example : Ammonium Nitrate is 33% N
- 3 # NH_4NO_3 = ~1lb Actual Nitrogen

Practical Nitrogen Sources

Material	%N	Salt Index*	Comments
Anhydrous Ammonia (NH_3)	82	47	Very volatile Liquid/Gas
Urea (NH_2-CO-NH_2)	46	75	Volatile Dry Material
Ammonium Nitrate (NH_4NO_3)	34	105	Dry Material Less Volatile
Nitrogen Solutions (UAN) Urea +NH_4NO_3 + water	28-32	74	Volatile, usually Injected in Drip
Ammonium Sulfate $(NH_4)_2SO_4$	21	69	Volatile on High pH soils

* Compared to Sodium Nitrate (=100)

Practical Nitrogen Management

- **Broadcast First Application in Spring? (Rainfall Dependent)**
- **NOT Necessary Well Before Budbreak!**
- **Make Nutrients Available to As Many Roots As Possible**
- **Summer Applications May Be Best Applied Through Drip System**

Best Guide For Analyzing Nitrogen Program in Bearing Trees?

1.) Canopy Fill/ Fruitfulness

2.) Leaf Color

3.) Leaf Health Post-Harvest

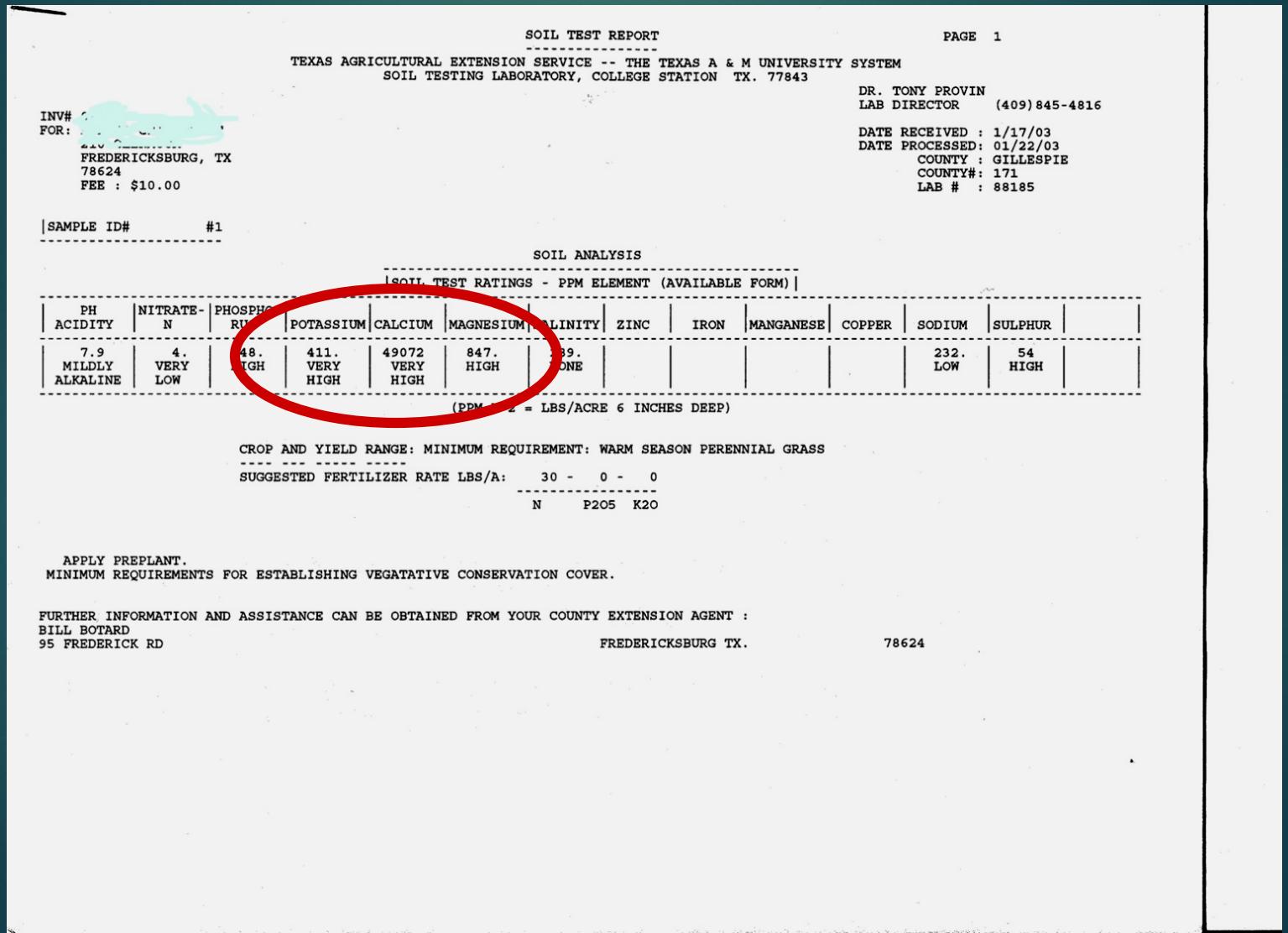
Phosphorus?

- Moves Very Slowly in Soils
- Acidic Soils May Need Additions
- Additions Best Made Pre-Plant, Then Incorporated
- High pH Soils?
  - Typically Have High Levels
  - Very Available
  - Olive Trees Are Very Adept At Picking up Phosphorus
  - Competition for Uptake With Iron and Zinc

Phosphorus Deficiency

Potassium/Magnesium/Calcium Why Leaf Sampling is a VERY Good Idea

Complicating Factors in South, Central & West Texas



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Potassium

- Mobile Nutrient
- Deficiencies First Appear After Bloom, but Usually Closer to Harvest
- More Severe Following Dry Bloom-Time Periods

Potassium Deficiency

Magnesium Deficiency

- **Mobile Nutrient**
- **Deficiencies First Appear After Bloom**
- **More Severe Following Wet Bloom-Time Periods**

Managing Potassium & Magnesium Deficiencies

- **Acid Soils May Need Liming Dolomitic Best Source of Mg**

- **Sulphate of Potassia and Magnesia on Neutral or High pH Soils**

K Mag 21.5% K_20, 18% MgO

or

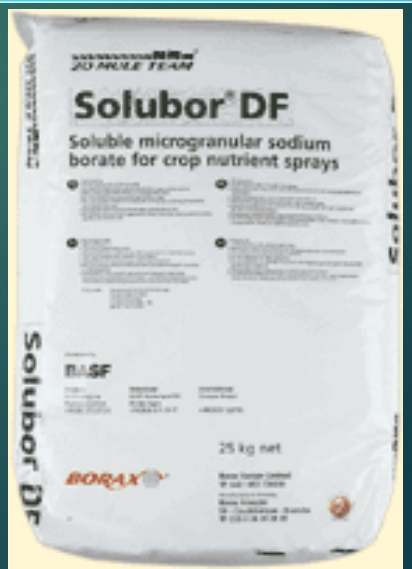
Sul-Po-Mag 18% K_20, 11% MgO

Strategies for Managing Potassium and Magnesium Additions

- **Leaf Sampling to Determine Following Year's Need**
- **Applications of Ground Applied Materials in the Fall, Following Harvest**
- **BAND Material Rather Than Broadcast**
- **Err on the Side of Ample Potassium Rather Than Magnesium**

Boron

- Mobile in Plants
- Key Uptake Occurs Post-Harvest
- Foliar Applications
- Soil Applications



Tissue Testing & Timing?

- **Yields Are Usually Suppressed Even Before Nitrogen Deficiency Symptoms are Evident**

- **Nitrogen Levels Early Season Fluctuate Greatly Between Sites, Varieties and Between Trees**

Mid-Summer Generally Recognized
As Best Time to Take Tissue for Analysis

Using Recently Matured Leaves

Leaf Tissue Testing

- Timing
- Washing
- Analysis
- Interpretation

Results Are Subject To Interpretation!

Standards???

Reasons Behind Problems

- ☞ Weed Control?
- ☞ Shallow Soils?
- ☞ Water?
- ☞ Disease?
- ☞ Imbalance?

Olive Leaf Nutrient Levels

Nutrient	Deficient	Optimum	Toxic
Nitrogen	< 1.4%	1.5 – 2.0%	> 2.55%
Phosphorus	< 0.05%	0.1 – 0.3%	> 0.34%
Potassium	< 0.4%	0.8 – 1.0%	> 1.65%
Calcium	< 0.6%	1.0 – 1.43%	> 3.15%
Magnesium	< 0.08%	0.1 – 0.16%	> 0.69%
Sulfur	< 0.02%	0.08 – 0.16%	> 0.32%
Iron	< 40 ppm	90 – 124 ppm	> 460 ppm
Zinc	< 8 ppm	10 - 24 ppm	> 84 ppm
Boron	< 14 ppm	19 – 150 ppm	>185 ppm
Manganese	< 5 ppm	20 – 36 ppm	> 164 ppm
Copper	< 1.5 ppm	4 - 9 ppm	> 78 ppm
Sodium			> 0.20%
Chloride		100 ppm	> 0.50%

Stan Kailis, David Harris, 2007

Non-Traditional Crop Additions?