# Understanding Your Soil Report

Michael Cook

2018

# Soil Sampling

## Advantage

- gives nutrient concentrations
- may shed light on soil issues
- “baseline” so look for trends
- can be done pre-plant
- timing not as critical


Courtesy of soiltesting.tamu.edu

## Disadvantage

- does not show soil/vine interaction
- concentration of nutrients, not vine availability

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# Timing & Frequency

- **Pre-planting** – *ideal time to make soil corrections*
- often collected during Fall or early Spring
- do not take when ground is frozen
- every **3-5 years** thereafter, unless major amendment is made

The data is only as good as how well a sample was collected

Use the same lab or a lab that performs similar diagnostic tests for consistency

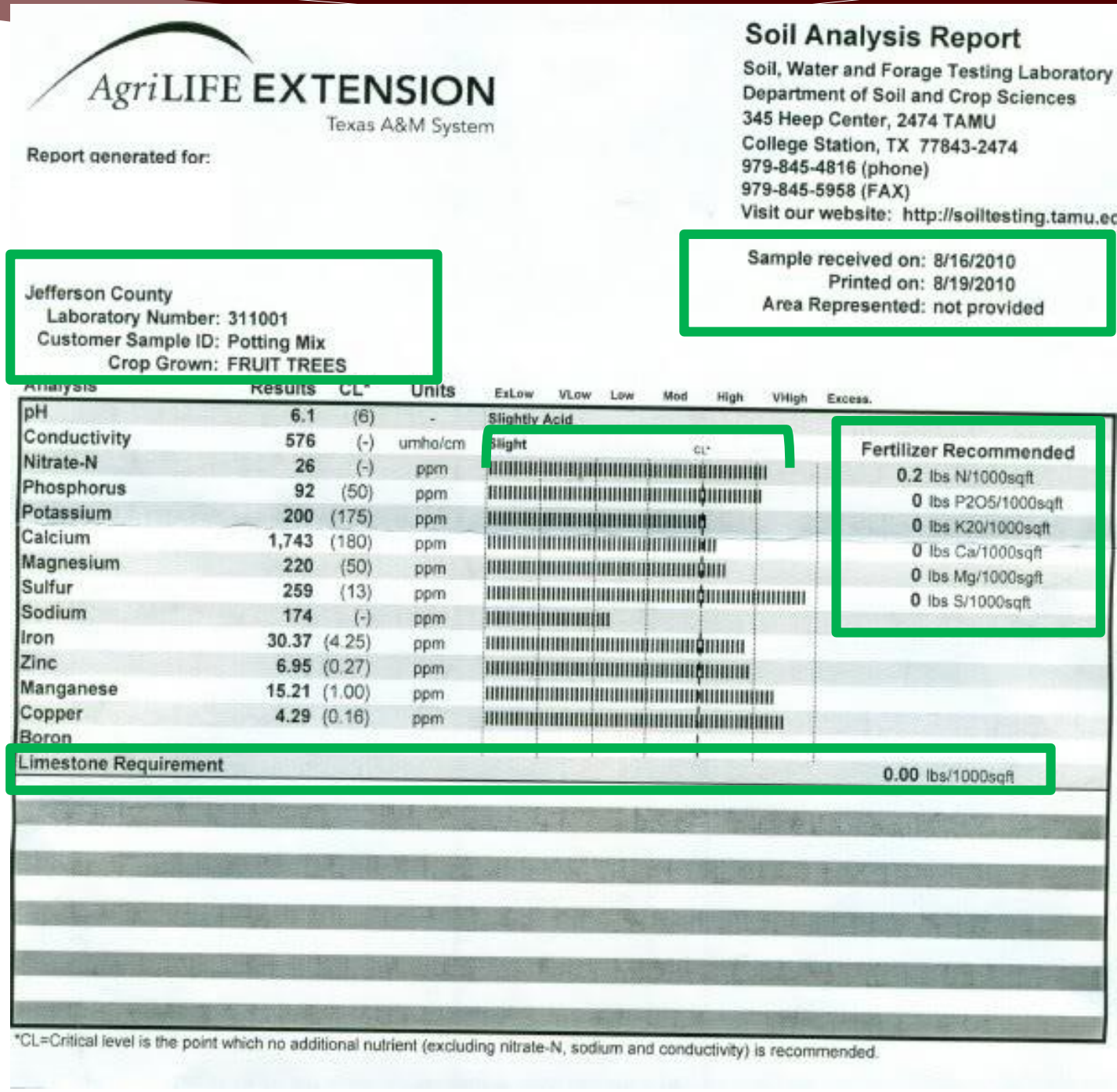
# AgriLife Soil, Water & Forage Lab

- **Soils Lab**
  - Department of Soil & Crop Sciences
    - Mehlich-3 method to extract plant-available nutrients

Texas A&M AgriLife Extension

# Interpretation

**Rule 1:** lab test recommendations are often auto-generated and are generally geared towards annual crops rather than perennial



AgriLIFE EXTENSION
Texas A&M System

Report generated for:

**Soil Analysis Report**
Soil, Water and Forage Testing Laboratory
Department of Soil and Crop Sciences
345 Heep Center, 2474 TAMU
College Station, TX 77843-2474
979-845-4816 (phone)
979-845-5958 (FAX)
Visit our website: http://soiltesting.tamu.ec

Jefferson County
Laboratory Number: 311001
Customer Sample ID: Potting Mix
Crop Grown: FRUIT TREES

Sample received on: 8/16/2010
Printed on: 8/19/2010
Area Represented: not provided

| Analysis | Results | CL* | Units | ExLow VLow Low Mod High VHigh Excess. |
|---|---|---|---|---|
| pH | 6.1 | (6) | - | Slightly Acid |
| Conductivity | 576 | (-) | umho/cm | Slight CL* |
| Nitrate-N | 26 | (-) | ppm | |
| Phosphorus | 92 | (50) | ppm | |
| Potassium | 200 | (175) | ppm | |
| Calcium | 1,743 | (180) | ppm | |
| Magnesium | 220 | (50) | ppm | |
| Sulfur | 259 | (13) | ppm | |
| Sodium | 174 | (-) | ppm | |
| Iron | 30.37 | (4.25) | ppm | |
| Zinc | 6.95 | (0.27) | ppm | |
| Manganese | 15.21 | (1.00) | ppm | |
| Copper | 4.29 | (0.16) | ppm | |
| Boron | | | | |

**Fertilizer Recommended**
0.2 lbs N/1000sqft
0 lbs P2O5/1000sqft
0 lbs K2O/1000sqft
0 lbs Ca/1000sqft
0 lbs Mg/1000sqft
0 lbs S/1000sqft

Limestone Requirement 0.00 lbs/1000sqft

*CL=Critical level is the point which no additional nutrient (excluding nitrate-N, sodium and conductivity) is recommended.

# Rule 2

Just because you selected GRAPES on the crop grown section does not mean the recommendations are for GRAPES

# What kind of information can you extract from a soil test?

- Soil pH
- Macronutrient concentration
- Micronutrient concentration
- Organic matter content
- Soil texture (sand, silt, clay)
- Detailed salinity panel
- Lime recommendations (be careful!)

# What is soil pH?

- a measure of hydrogen ion activity in the soil solution
- Logarithmic scale
  - a change in one unit (ex 5 to 6) = a 10 fold increase in soil acidity.
- may change +/- 1 point during season
- What causes soil acidity?
  - Parent material
  - Leaching
  - Cultural

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Department of Soil and Crop Sciences
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College Station, TX 77843-2478
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979-845-5958 (FAX)
Visit our website: http://soiltesting.tamu.edu

Report generated for:
Michael Cook
2406 Bonham Trl
Grapevine, TX 76051

Sample received on: 9/26/2016
Printed on: 9/30/2016
Area Represented: 2 acres

Denton County
Laboratory Number: 467874
Customer Sample ID: A
Crop Grown: GRAPES

| Analysis | Results | CL* | Units | |
|---|---|---|---|---|
| pH | 7.2 | (5.8) | - | Slightly Alkaline |
| Conductivity | 296 | (-) | dmho/cm | None |
| Nitrate-N | 0 | (-) | ppm** | |
| Phosphorus | 24 | (50) | ppm | |
| Potassium | 313 | (150) | ppm | |
| Calcium | 5,861 | (180) | ppm | |
| Magnesium | 278 | (50) | ppm | |
| Sulfur | 12 | (13) | ppm | |
| Sodium | 28 | (-) | ppm | |
| Iron | | | | |
| Zinc | | | | |
| Manganese | | | | |
| Copper | | | | |
| Boron | | | | |
| Limestone Requirement | | | | |

Low Med High VHigh Excess. CL*

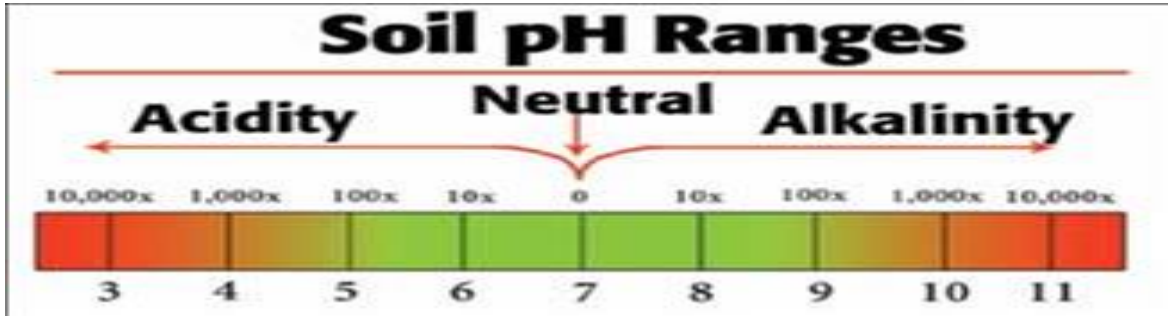
Fertilizer Recommended
20 lbs N/acre
15 lbs P2O5/acre
0 lbs K20/acre
0 lbs Ca/acre
0 lbs Mg/acre
5 lbs S/acre

0.00 tons 100ECCE/acre

Textural Analysis Test (hydrometer)

| | | |
|---|---|---|
| Sand | 22 | % |
| Silt | 42 | % |
| Clay | 36 | % |
| Textural Class: | Clay Loam | |

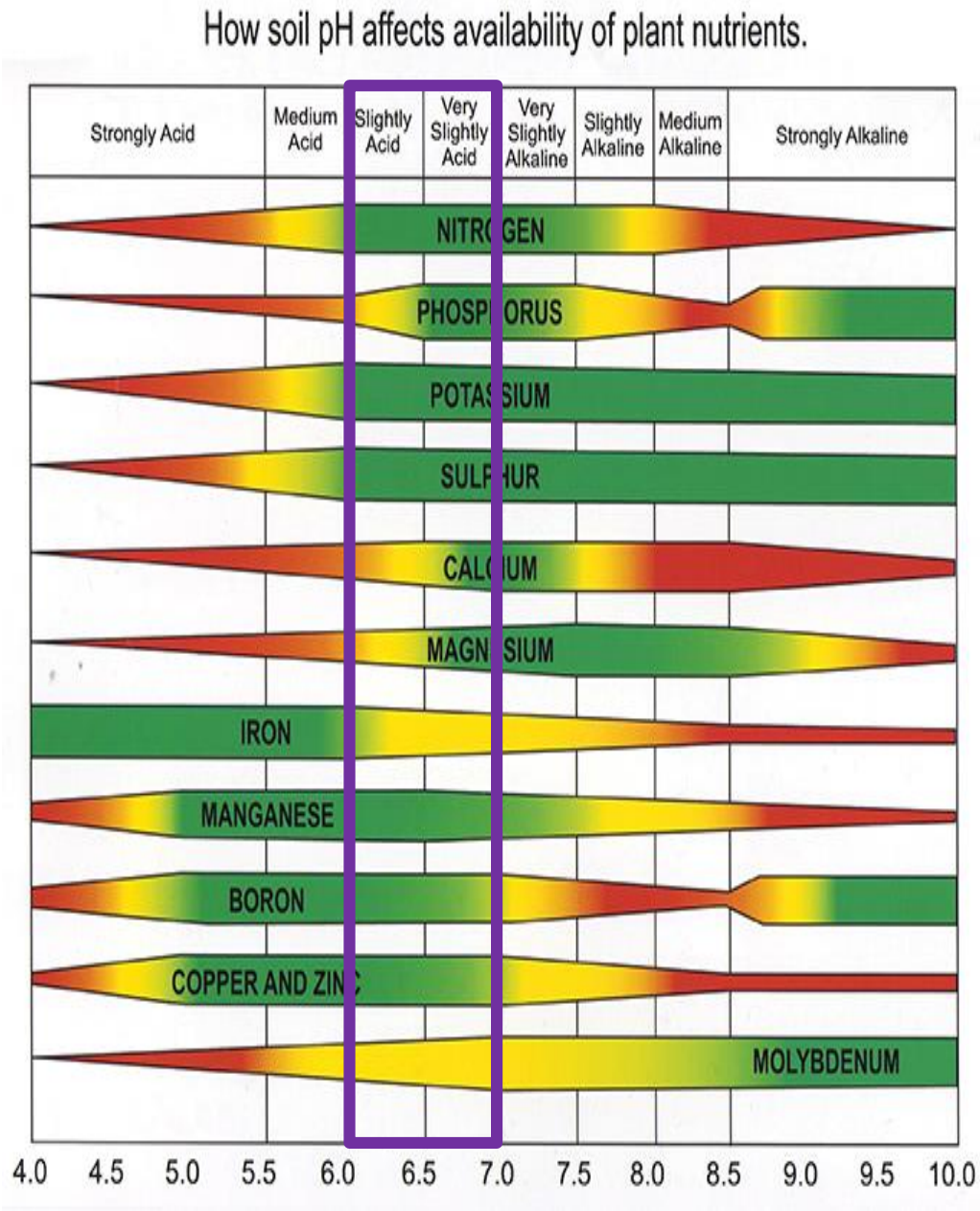
*CL=Critical level is the point which no additional nutrient (excluding nitrate-N, sodium and conductivity) is recommended. **ppm=mg/kg



# Soil pH

- Affects mineral solubility
  - may be found in soil but not available
  - Soil report just shows us
  - Alkaline soils
    - Fe and Zn unavailable to vine

Ideal range: 5.5-6.5



# Is Liming Necessary?

## Often for highly acidic soils (<5.0)

- **Not all limestones are the same**
  - Based on particle size and purity
    - neutralizing value of material
  - Smaller particles have + surface area, react more rapidly to change in soil pH, and thus have a higher efficiency rating (ER)
  - **Effective Calcium Carbonate Equivalent (ECCE)** – based on pure calcium carbonate, gives percentage of effective limestone to neutralize acid

# Lime Recommendations

**Table 1. Approximate Amount of Finely Ground Limestone Needed to Raise the pH of a 7-inch Layer of Soil**

| Lime Requirements (Tons per Acre) | | |
|---|---|---|
| **Soil Texture** | **From pH 4.5 to 5.5** | **From pH 5.5 to 6.5** |
| Sand and loamy sand | 0.5 | 0.6 |
| Sandy loam | 0.8 | 1.3 |
| Loam | 1.2 | 1.7 |
| Silt loam | 1.5 | 2.0 |
| Clay loam | 1.9 | 2.3 |
| Muck | 3.8 | 4.3 |

**Table 2. Common Liming Materials**

http://vric.ucdavis.edu

| **Name** | **Chemical Formula** | **Equivalent % $CaCO_3$** | **Source** |
|---|---|---|---|
| Shell meal | $CaCo_3$ | 95 | Natural shell deposits |
| Limestone | $CaCO_3$ | 100 | Pure form, finely ground |
| Hydrated lime | $Ca(OH)_2$ | 120-135 | Steam burned |
| Burned lime | CaO | 150-175 | Kiln burned |
| Dolomite | $CaCO_3 – M_gCO_3$ | 110 | Natural deposit |
| Sugar beet lime | $CaCO_3$ | 80-90 | Sugar beet by-product lime |
| Calcium silicate | $CaSiO_3$ | 60-80 | Slag |

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AGRILIFE EXTENSION

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Report generated for:
Michael Cook
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Grapevine, TX 76051

Sample received on: 9/26/2016
Printed on: 9/30/2016
Area Represented: 2 acres

Denton County
Laboratory Number: 467874
Customer Sample ID: A
Crop Grown: GRAPES

| Analysis | Results | CL* | Units | ExLow VLow Low Mod High VHigh Excess. | Fertilizer Recommended |
|---|---|---|---|---|---|
| pH | 7.2 | (5.8) | - | Slightly Alkaline | |
| Conductivity | 298 | (-) | umho/cm | None | |
| Nitrate-N | 0 | (-) | ppm** | | 20 lbs N/acre |
| Phosphorus | 24 | (50) | ppm | | 15 lbs P2O5/acre |
| Potassium | 313 | (150) | ppm | | 0 lbs K20/acre |
| Calcium | 5,861 | (180) | ppm | | 0 lbs Ca/acre |
| Magnesium | 278 | (50) | ppm | | 0 lbs Mg/acre |
| Sulfur | 12 | (13) | ppm | | 5 lbs S/acre |
| Sodium | 28 | (-) | ppm | | |
| Iron | | | | | |
| Zinc | | | | | |
| Manganese | | | | | |
| Copper | | | | | |
| Boron | | | | | |
| Limestone Requirement | | | | | 0.00 tons 100ECCE/acre |

Textural Analysis Test (hydrometer)

| | | |
|---|---|---|
| Sand | 22 | % |
| Silt | 42 | % |
| Clay | 36 | % |
| Textural Class: | Clay Loam | |

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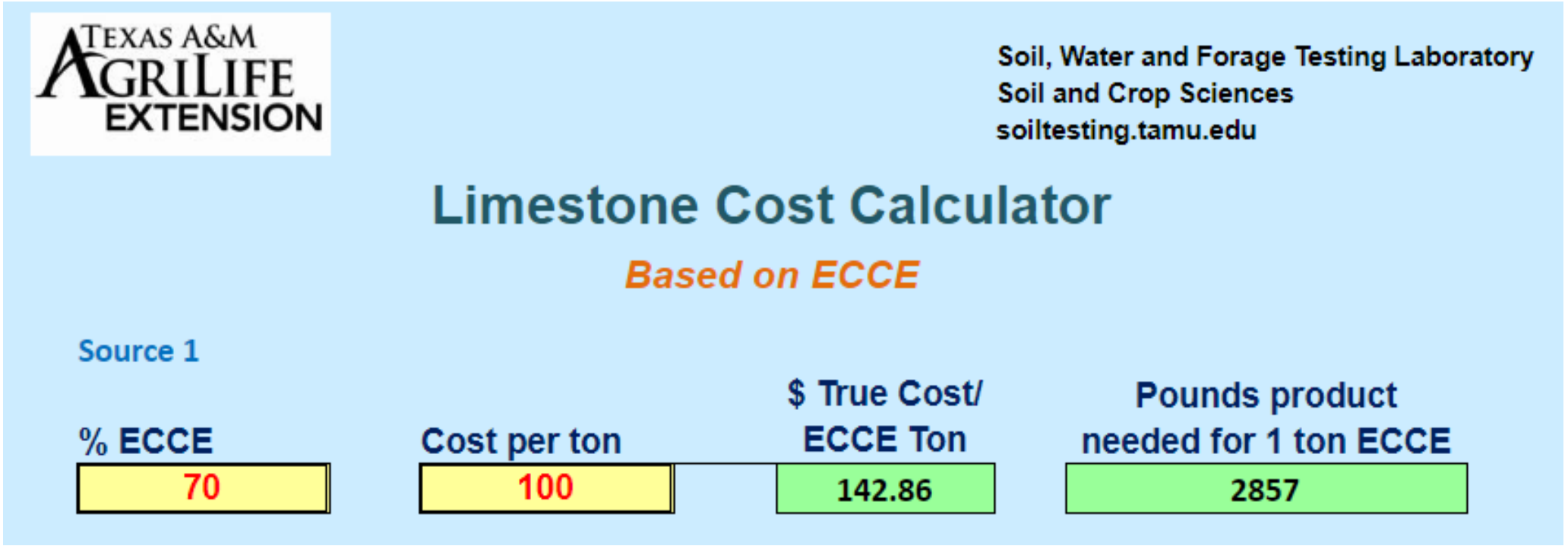
# Lime Requirement Calculator

Soiltesting.tamu.edu

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# What about acidifying my soil?

- Cost prohibitive on commercial scale
- Takes time and benefits are short lived due to buffer capacity of soil
- Adding elemental sulfur, certain fertilizers, adding OM, dripping with sulfuric acid

# Electrical Conductivity (EC)

- **Electrical conductivity of the soil**
  - used to determine potential risk of salt injury
  - includes all soluble salts, not just sodium chloride
  - can vary dramatically
    - greatly influenced by environmental conditions (i.e. rainfall)

| Analysis (Salinity) | No Problem | Increasing Problem | Severe Problem |
|---|---|---|---|
| **EC** dS/m or mmho/cm | 1.5 to 2.5 | 2.5 to 4.0 | 4.0 to 7.0 |
| **TDS** ppm or mg/L | 960 to 1600 | 1600 to 2560 | 2560 to 5600 |

# Target Values for Vineyard Soil Nutrients

| Nutrient | Target soil values (ppm) | Target soil values (lbs/acre) |
|---|---|---|
| Potassium (K) | 75-100 | 150-200 |
| Phosphorus (P) | 20-50 | 40-100 |
| Calcium (Ca) | 500-2,000 | 1,000-4,000 |
| Magnesium (Mg) | 100-250 | 200-500 |
| Boron (B) | 0.3-2 | 0.6-4 |
| Iron (Fe) | 20 | 40 |
| Manganese (Mn) | 20 | 40 |
| Copper (Cu) | 0.5 | 1.0 |
| Zinc (Zn) | 2 | 4 |
| Organic Matter | 3-5% | |

From: T. Wolf, Winegrape Production Guide for Eastern North America

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# Nitrogen (N)

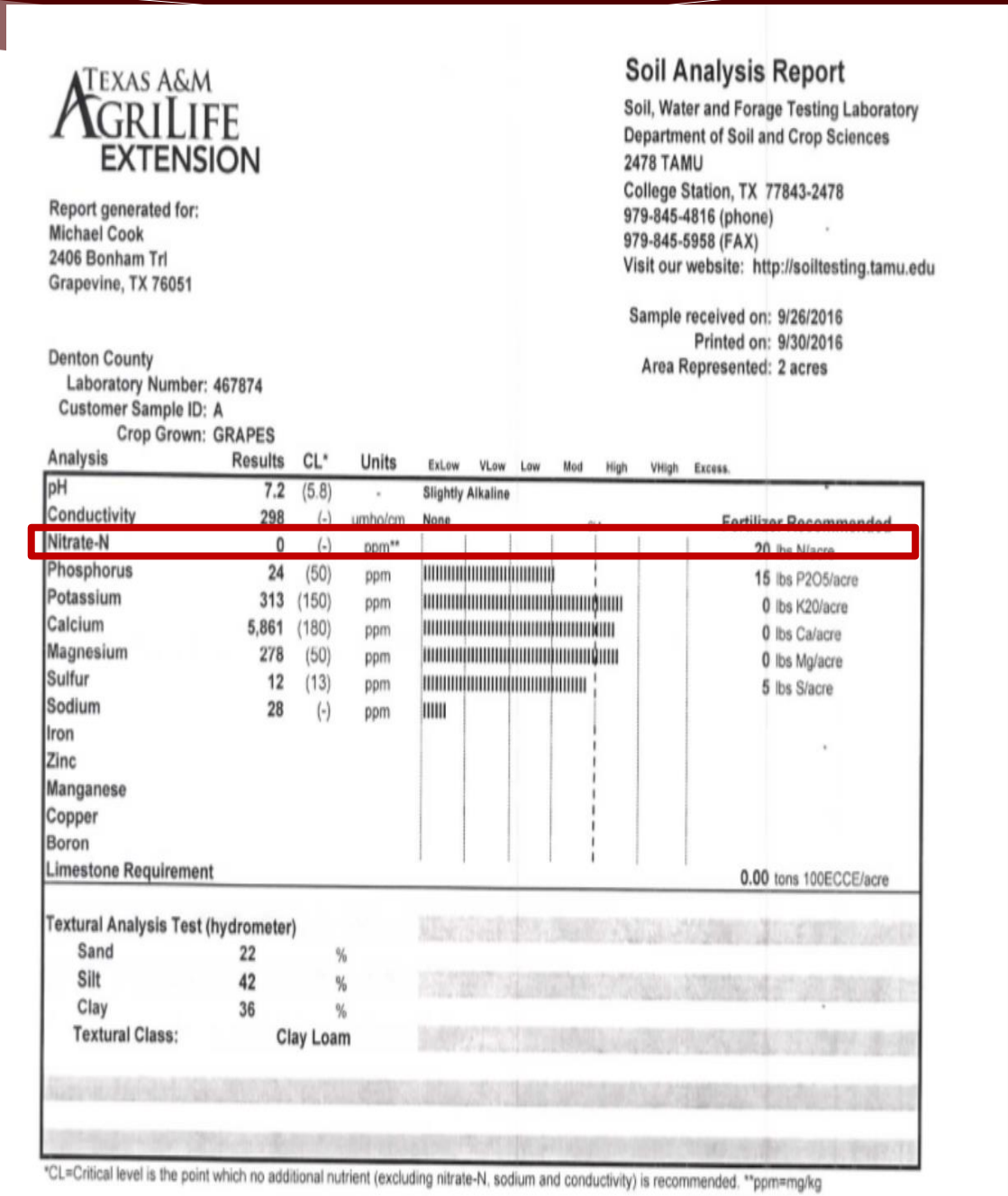
Do not rely on a soil report for nitrogen recommendations

- multiple forms present in soil
- status changes rapidly

***Petiole test is recommended***

General rule of thumb:

- young vineyards add a small dose of nitrogen per vine as a boost
- annual maintenance dose of 20-30 lbs. of actual N per acre.



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Denton County
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|---|---|---|---|---|---|
| pH | 7.2 | (5.8) | - | Slightly Alkaline | |
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| Nitrate-N | 0 | (-) | ppm** | | 20 lbs N/acre |
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| Boron | | | | | |
| Limestone Requirement | | | | | 0.00 tons 100ECCE/acre |

| Textural Analysis Test (hydrometer) | | |
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# How Much Fertilizer to Apply?

- Do not rely on auto generated calculations. You can do it yourself.

## Acre-Furrow Slice

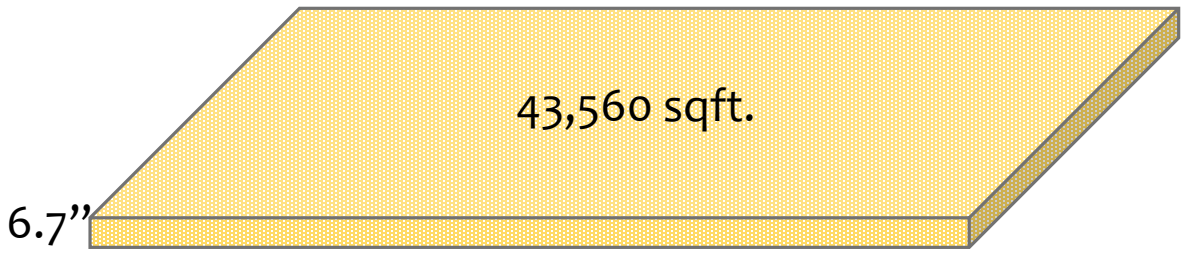
q weighs about 2 million pounds. The depth of normal plowing or about 6.5 inches.

### How is it determined?

(avg. B.D.- 1.36) x (wt. of cu ft of water - 62.4 lbs)

x (volume of an acre 6.5 in. deep - 23,522 cu ft)

Default means by which labs generate recommendations



# PPM conversions to memorize

6” soil sample = PPM x 2 = lbs. per acre

12” soil sample = PPM x 4 = lbs. per acre

lbs. per ton = PPM x 0.002

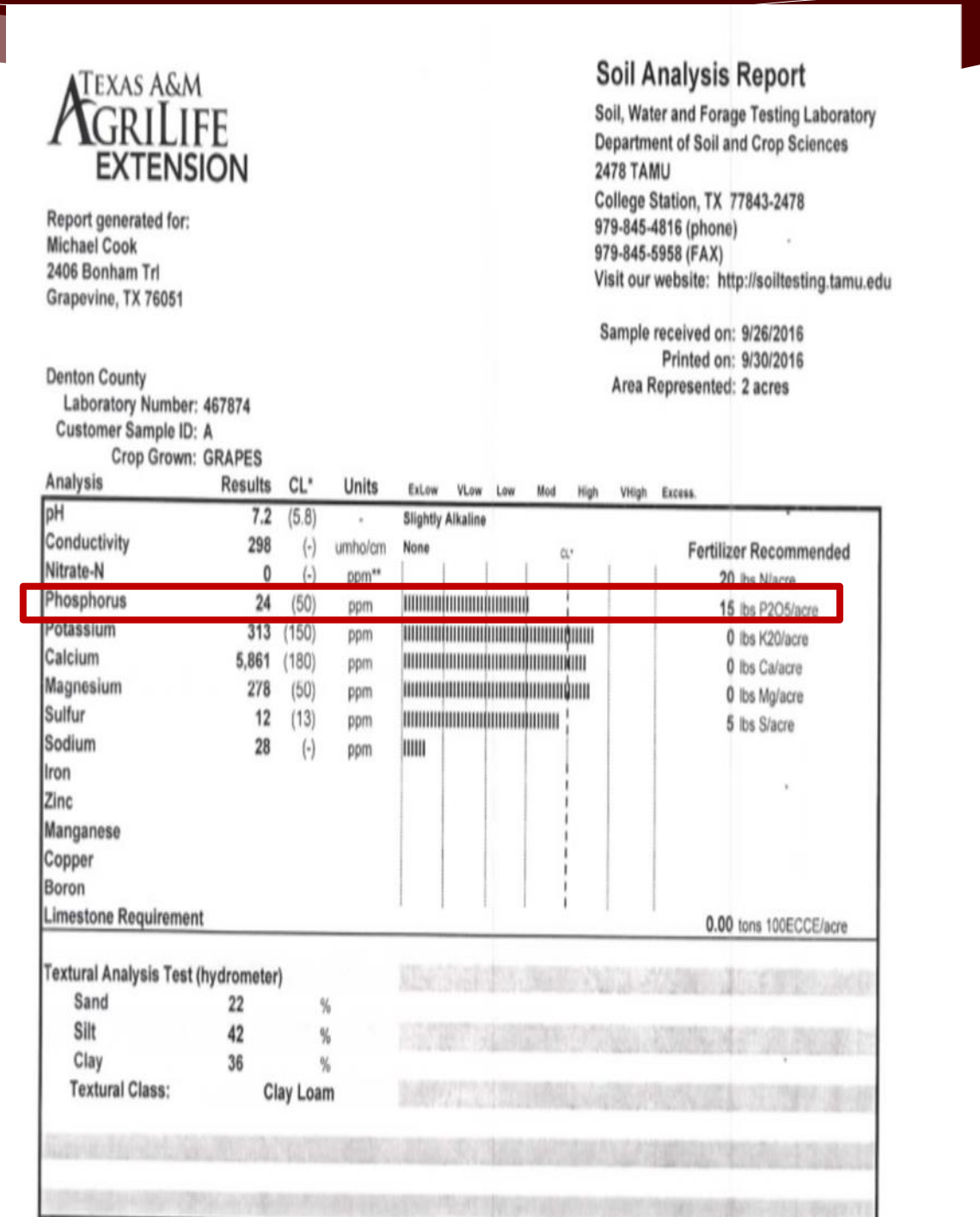
lbs. per 1,000 gallons = PPM x 0.00834

% = PPM x 0.0001

# How to calculate?

## Phosphorus

- **Grape Recommendation:** 20-50ppm
  - 30 ppm x 2 = 60 lbs./acre
- **Soil Report =** 24ppm
  - **24ppm x 2 =** 48 lbs./acre
  - **Need to apply 12 lbs./acre of actual P**



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| Boron | | | | | |
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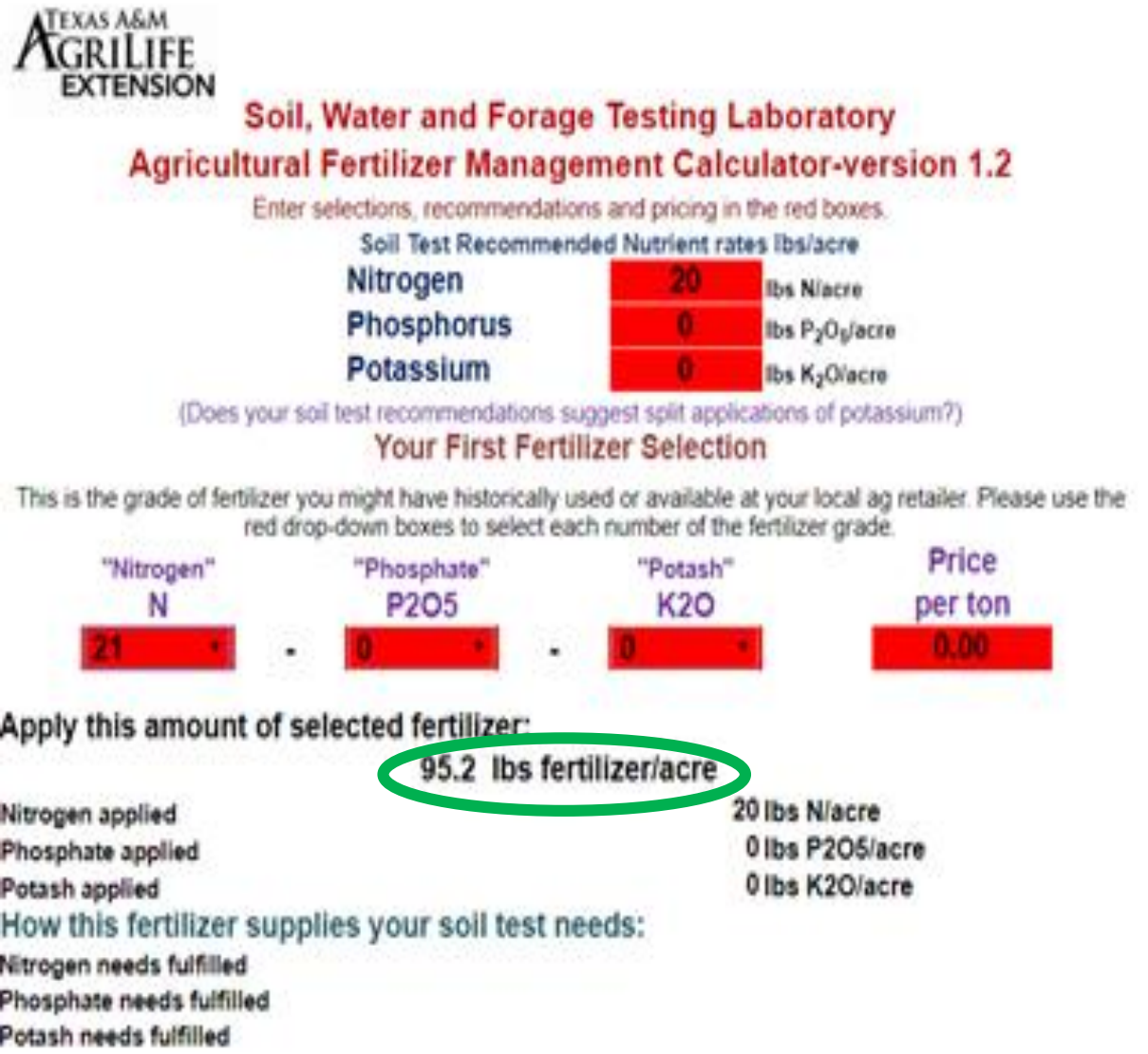
| Clay | 36 | % |
| Textural Class: | Clay Loam | |

http://soiltesting.tamu.edu/webpages/calculator.html



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## Soil, Water and Forage Testing Laboratory

## Agricultural Fertilizer Management Calculator-version 1.2

Enter selections, recommendations and pricing in the red boxes.

Soil Test Recommended Nutrient rates lbs/acre

| | | |
|---|---|---|
| Nitrogen | 20 | lbs N/acre |
| Phosphorus | 0 | lbs $P_2O_5$/acre |
| Potassium | 0 | lbs $K_2O$/acre |

(Does your soil test recommendations suggest split applications of potassium?)

### Your First Fertilizer Selection

This is the grade of fertilizer you might have historically used or available at your local ag retailer. Please use the red drop-down boxes to select each number of the fertilizer grade.

| "Nitrogen" N | | "Phosphate" P2O5 | | "Potash" K2O | Price per ton |
|---|---|---|---|---|---|
| 21 | - | 0 | - | 0 | 0.00 |

**Apply this amount of selected fertilizer:**

**95.2 lbs fertilizer/acre**

| | |
|---|---|
| Nitrogen applied | 20 lbs N/acre |
| Phosphate applied | 0 lbs P2O5/acre |
| Potash applied | 0 lbs K2O/acre |

### How this fertilizer supplies your soil test needs:

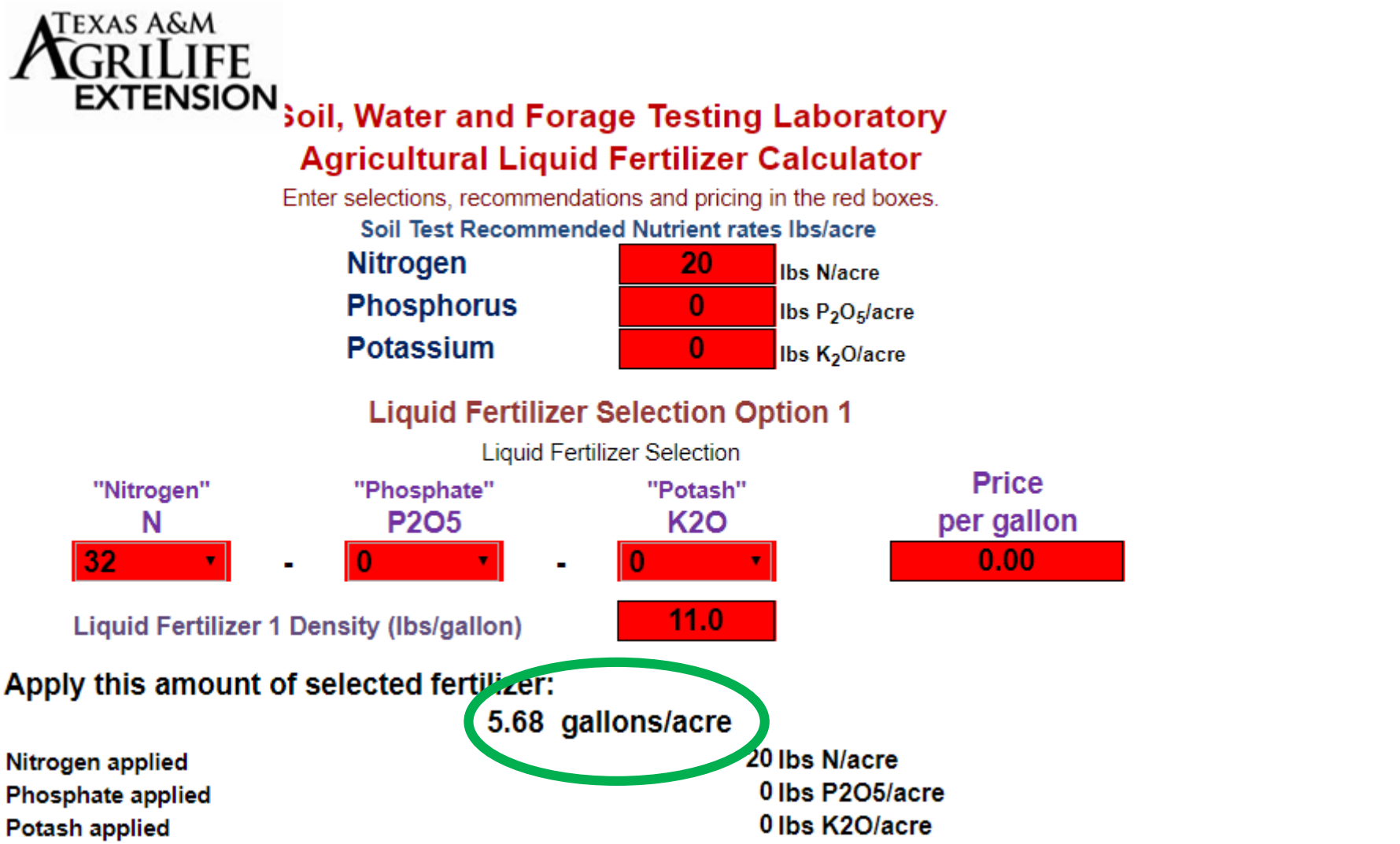
Nitrogen needs fulfilled

Phosphate needs fulfilled

Potash needs fulfilled

Texas A&M AgriLife Extension

# Liquid Forms



Soil, Water and Forage Testing Laboratory

Agricultural Liquid Fertilizer Calculator

Enter selections, recommendations and pricing in the red boxes.

Soil Test Recommended Nutrient rates lbs/acre

| | | |
|---|---|---|
| Nitrogen | 20 | lbs N/acre |
| Phosphorus | 0 | lbs $P_2O_5$/acre |
| Potassium | 0 | lbs $K_2O$/acre |

Liquid Fertilizer Selection Option 1

Liquid Fertilizer Selection

| "Nitrogen" N | | "Phosphate" P2O5 | | "Potash" K2O | Price per gallon |
|---|---|---|---|---|---|
| 32 | - | 0 | - | 0 | 0.00 |

Liquid Fertilizer 1 Density (lbs/gallon) 11.0

Apply this amount of selected fertilizer:

5.68 gallons/acre

| | |
|---|---|
| Nitrogen applied | 20 lbs N/acre |
| Phosphate applied | 0 lbs P2O5/acre |
| Potash applied | 0 lbs K2O/acre |

# Multi-depth sampling

Crop Grown: GRAPES

| Analysis | Results | CL* | Units |
|---|---|---|---|
| pH | 6.7 | (5.8) | - |
| Conductivity | 128 | (-) | umho/cm |
| Nitrate-N | 1 | (-) | ppm** |
| Phosphorus | 31 | (50) | ppm |
| Potassium | 46 | (150) | ppm |
| Calcium | 869 | (180) | ppm |
| Magnesium | 98 | (50) | ppm |
| Sulfur | 11 | (13) | ppm |
| Sodium | 33 | (-) | ppm |
| Iron | 41.11 | (4.25) | ppm |
| Zinc | 3.41 | (0.27) | ppm |
| Manganese | 13.74 | (1.00) | ppm |
| Copper | 0.45 | (0.16) | ppm |
| Boron | 0.05 | (0.60) | ppm |
| Limestone Requirement | | | |

0-8" deep

Crop Grown: GRAPES

| Analysis | Results | CL* | Units |
|---|---|---|---|
| pH | 7.6 | (5.8) | - |
| Conductivity | 227 | (-) | umho/cm |
| Nitrate-N | 1 | (-) | ppm** |
| Phosphorus | 4 | (50) | ppm |
| Potassium | 79 | (150) | ppm |
| Calcium | 1,505 | (180) | ppm |
| Magnesium | 227 | (50) | ppm |
| Sulfur | 14 | (13) | ppm |
| Sodium | 354 | (-) | ppm |
| Iron | 18.66 | (4.25) | ppm |
| Zinc | 7.15 | (0.27) | ppm |
| Manganese | 3.10 | (1.00) | ppm |
| Copper | 0.43 | (0.16) | ppm |
| Boron | 1.43 | (0.60) | ppm |
| Limestone Requirement | | | |

8-20" deep

# Only apply what is required

Temptation to purchase broad fertilizers like 13-13-13

- repeated use can lead to major nutritional issues that are nearly impossible to ameliorate
- many organic sources (i.e chicken manure) contain high concentrations of P

**Soil nutrient relationships are complex**

- Too much Phosphorous can tie up Zinc
- Too much Potassium can tie up Magnesium

# Do I apply the recommended rate all at once?

- Timing and application rates (all or split) is dependent on the characteristics of the nutrient
  - Ex. nitrogen = leaches easily, volatile formulations, do not add late season, split applications often necessary

# Any Questions?

m.cook@tamu.edu

winegrapes.tamu.edu


'Texas Viticulture & Enology'