

# Soil Selection Factors

- Internal Drainage Characteristic
  - Most important
  - Roots need aeration to function
- Moisture Holding Capacity
  - Texture
  - Depth
- pH
- Fertility

# Chances of Success are Limited Under Conditions of Poor Soil Drainage



# Reasons for Poor Soil Drainage

- Poor surface runoff
  - Slope
  - Depressions
- Lateral seepage
  - On slopes
  - Textural change
- Texture
  - High clay content
- Impervious layer in substrata
  - Clay layer
  - Compacted layer
  - Abrupt textural change
- High water table

# Soil Information is Available in County Soil Survey

- Soil Series Description:
  - Texture, Drainage, Fertility, Erosion
- Soil Profile Classification:
  - Structure
- Table of Engineering Index Properties:
  - Soil texture classification by depth
- Table of Physical & Chemical Properties:
  - Permeability, Available water holding capacity, Organic matter content

# Soil Drainage Classification

<b>Very poorly drained</b>	<b>AVOID</b>
<b>Poorly drained</b>	<b>Avoid</b>
<b>Somewhat poorly drained</b>	<b>Marginal</b>
<b>Moderately well-drained</b>	<b>Suitable</b>
<b>Well-drained</b>	<b>Ideal</b>
<b>Excessively drained</b>	<b>Marginal</b>

# Dig Soil Test Holes

## Test Holes:

- 3 feet deep
- Fill with water
- Check after 72 hrs
- If water is still present:
  - Find another site
  - Take corrective measures

# What Can be Done to Improve Soil Drainage

- **Sub-soil before planting**
  - Effective for compacted soils.
- **Plant on raised beds**
  - Suitable on moderately well drained soils.
  - Maybe okay for somewhat poorly drained soils.
- **Install drainage tile**
  - Suitable for somewhat poorly drained soils.
  - Maybe okay of poorly drained soils (distance between tile lines & cost become a factor).

# Soil Preparation Sub-soiling



Only effective if soil has hard pan or similar structure with good soil beneath.

# Moisture Holding Capacity

Soil Texture

+

Soil Depth

# Available Soil Moisture

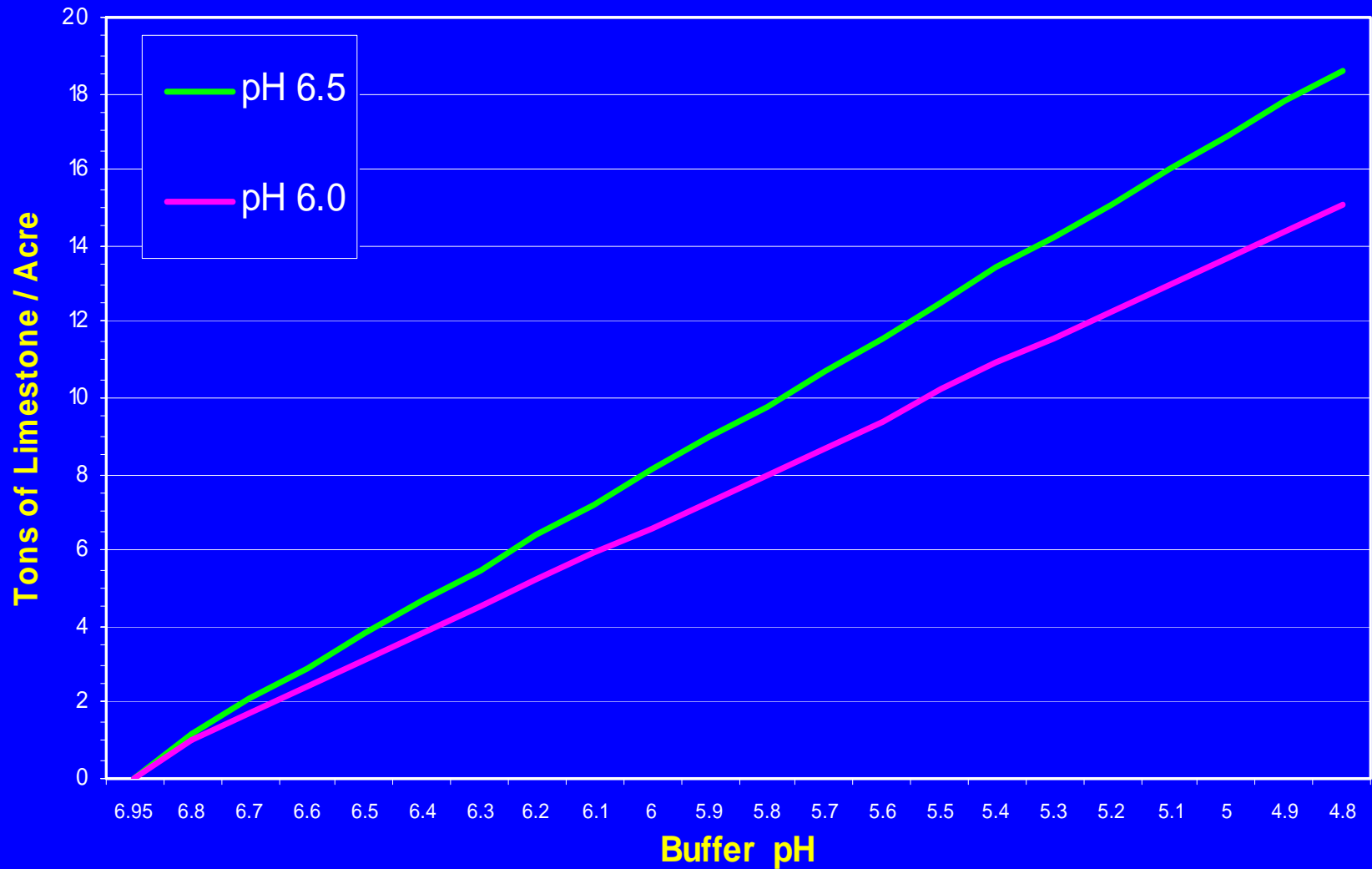
<b>Texture</b>	<b>Inches Per foot</b>
Sand	0.5
Loamy sand	1.0
Sandy loam	1.5
Loam	2.0
Silt loam	2.5
Clay loam	2.5
Clay	2.0

With depth, determines if irrigation is necessary

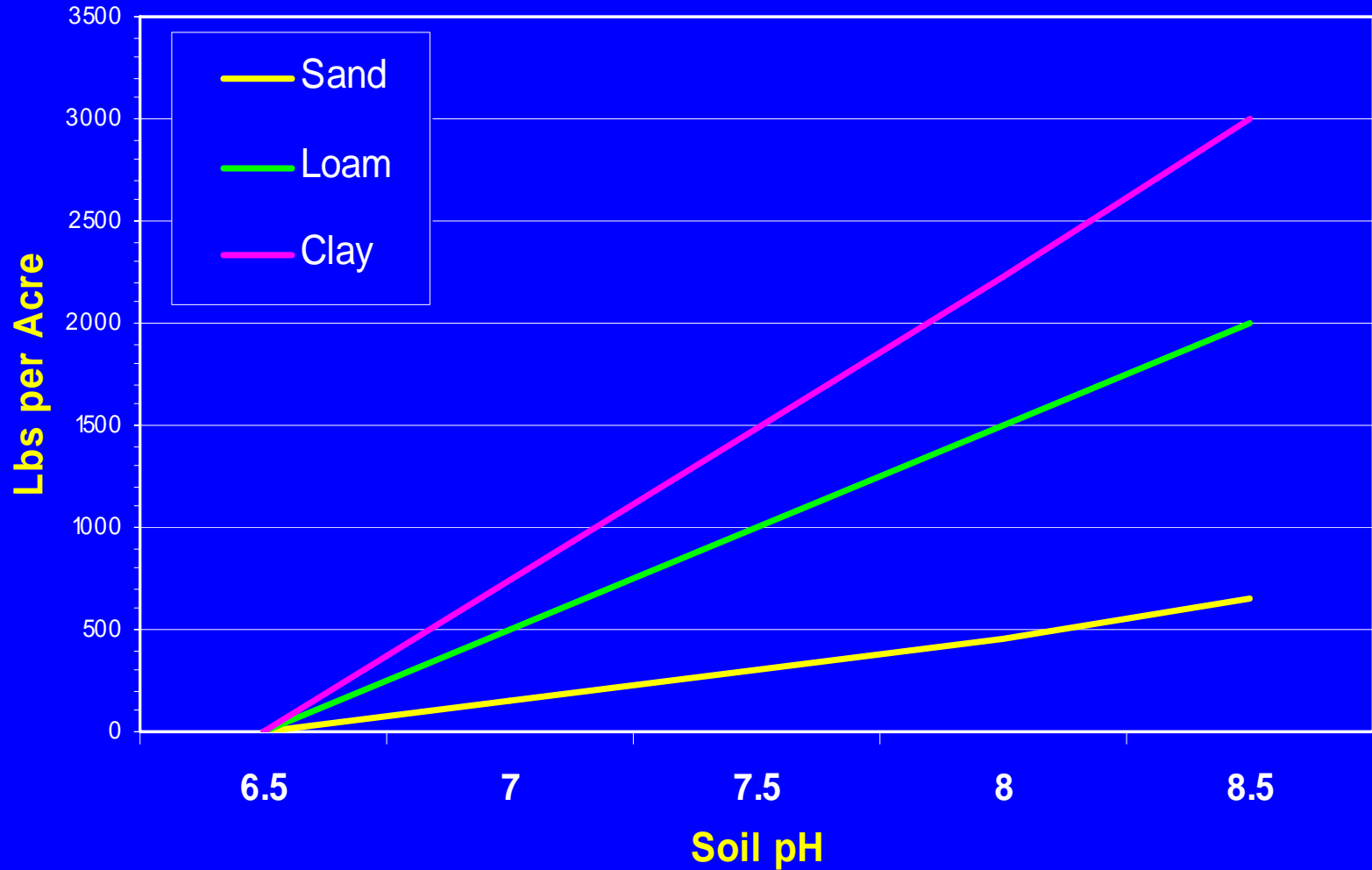
# Soil pH for Grapes

- **Optimum: 5.5 to 6.5**
  - American: 5.0 to 6.5
  - French Hybrid: 5.5 to 6.5; will tolerate a pH up to 7.0
- **Iowa Soils:**
  - 4.5 for some sands in eastern Iowa
  - 8.4 in northwest Iowa
  - Most Iowa soils are in near-neutral (7.0) to slightly alkaline (7.4) range. However, long term use of anhydrous ammonia can lower the pH to below 6.5.
- **Adjust Soil pH:**
  - Below 5.5: bring up to 6.0 or 6.5 with lime.
  - Above 7.0: consider lowering to 6.5 or 6.0 with sulfur, or using acid forming fertilizers (ammonium sulfate).

# Lime Requirement to Raise the Soil pH to 6.5 and 6.0

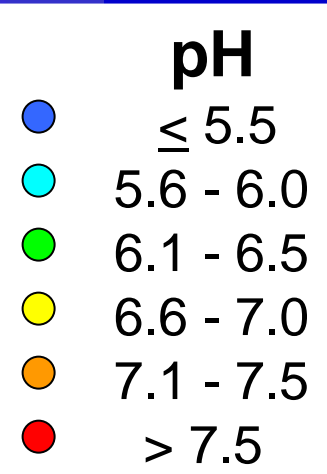
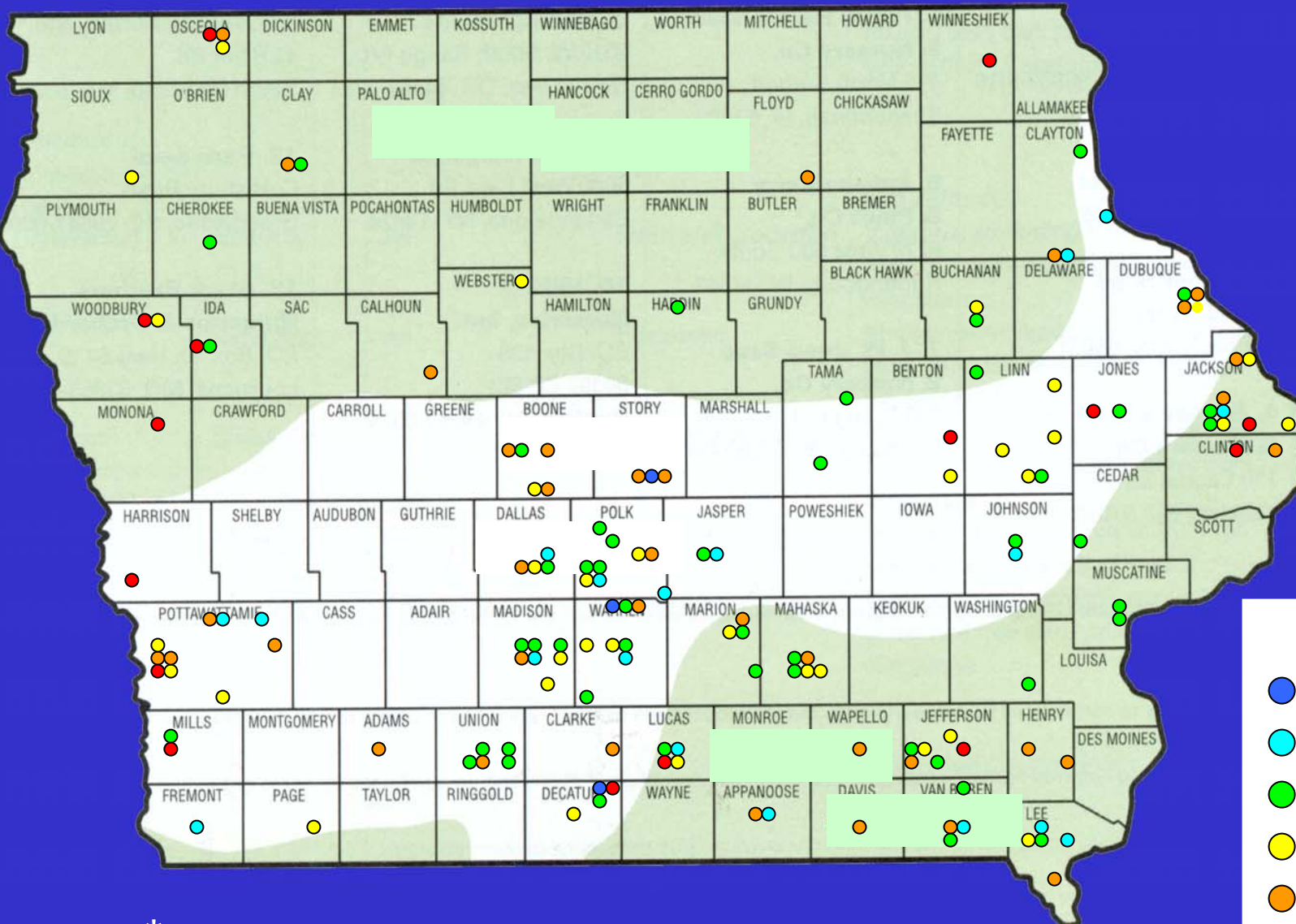


# Sulfur Requirement to Reduce the Soil pH to 6.5



Soil texture influences the amount of sulfur required to acidify a soil.

# Soil PH\*



\* Samples submitted from potential vineyard sites.

# Soil Fertility

- Least concern when selecting a site.

Can amend the soil.

- Iowa Soils: Concern for

- P Low in many Iowa soils.
- K Grapes have a high requirement for K, and many Iowa soils tie up K under non-cultivation as would occur in a vineyard.
- Zn Grapes have a relatively high requirement for Zn, and it is low in many Iowa soils.

- Pre-plant Soil Tests:

Test: pH, P, K, Zn, & organic matter content.

Ca (in lime), P, & K move very slowly in the soil & are very difficult to correct after planting.

- Collect samples from 2 depths:

0 to 6 (8) inches - Past fertilizer history

6 (8) to 12 (18) inches - Parent material

# Availability of Essential Mineral Nutrients

- Composition of the soil parent material.
- Soil pH
- Soil weathering / leaching
- Soil organic matter content
- Previous fertilizer history

# Pre-plant Soil Test

- Test for: **pH, P, K, Zn, O.M.**
- Separate sample for each soil type.
- Separate samples for different cropping histories (corn / soybean rotation can be considered a single cropping history).
- Submit samples collected from 2 depths:
  - 0 to 6 or 8 inch depth.
  - 6 or 8 inch to 12 or 16 inch depth.
- For samples sent to the ISU Soil Testing Lab. indicate on submission form that the results be sent to me for interpretation.

# Soil Organic Matter

- **Improves soil structure, moisture retention and fertility.**

2 to 3% is considered ideal for grapes.

- **Iowa Soils:**

Range from < 1% up to 20%

Well-drained soils in the 3 to 4% range

OM is higher in poorer drained soils.

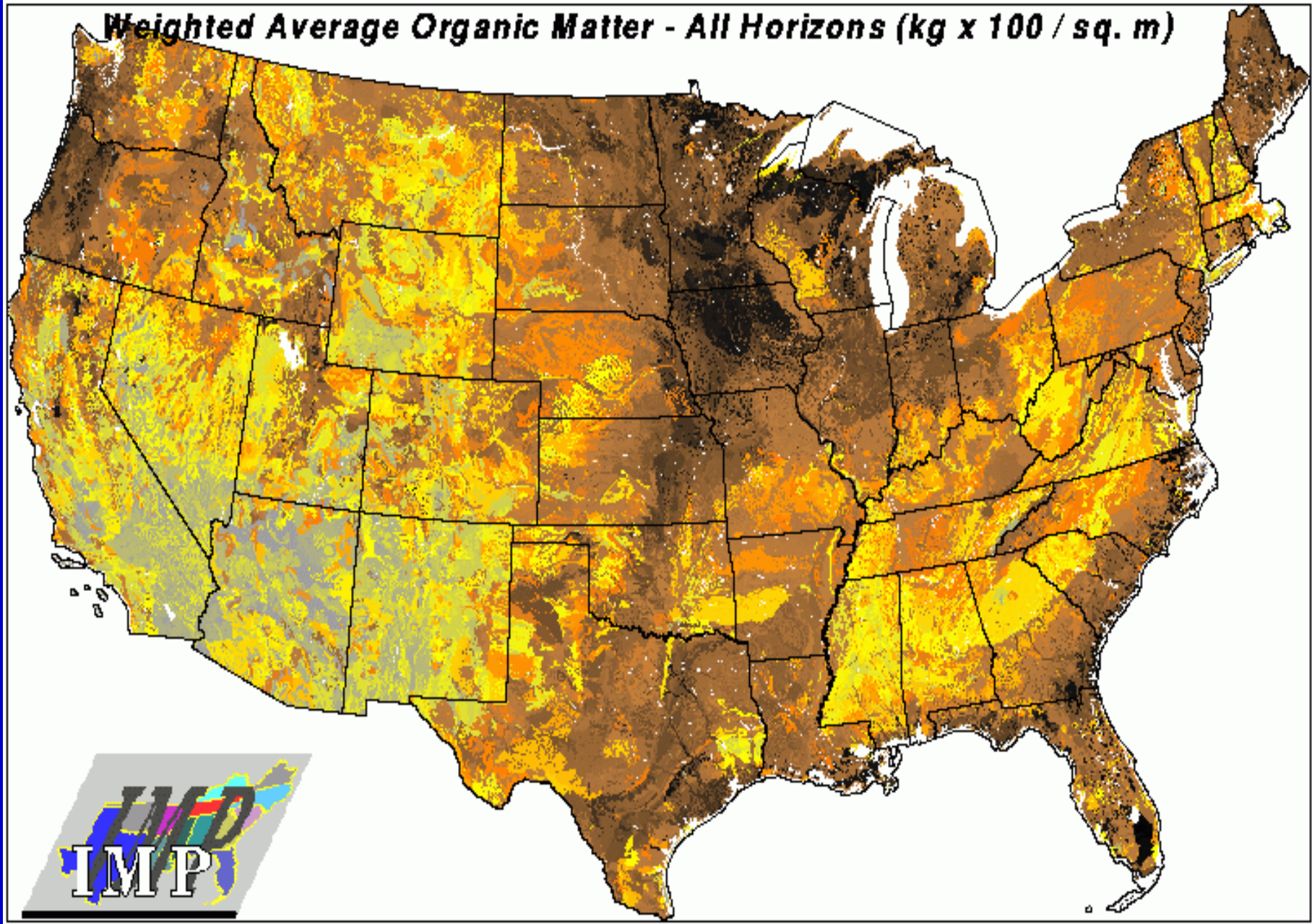
- **Grapes grown on high organic soils tend to be less winter hardy.**

Release of N from organic matter.

**20 lb N / % OM / Ac / Yr**

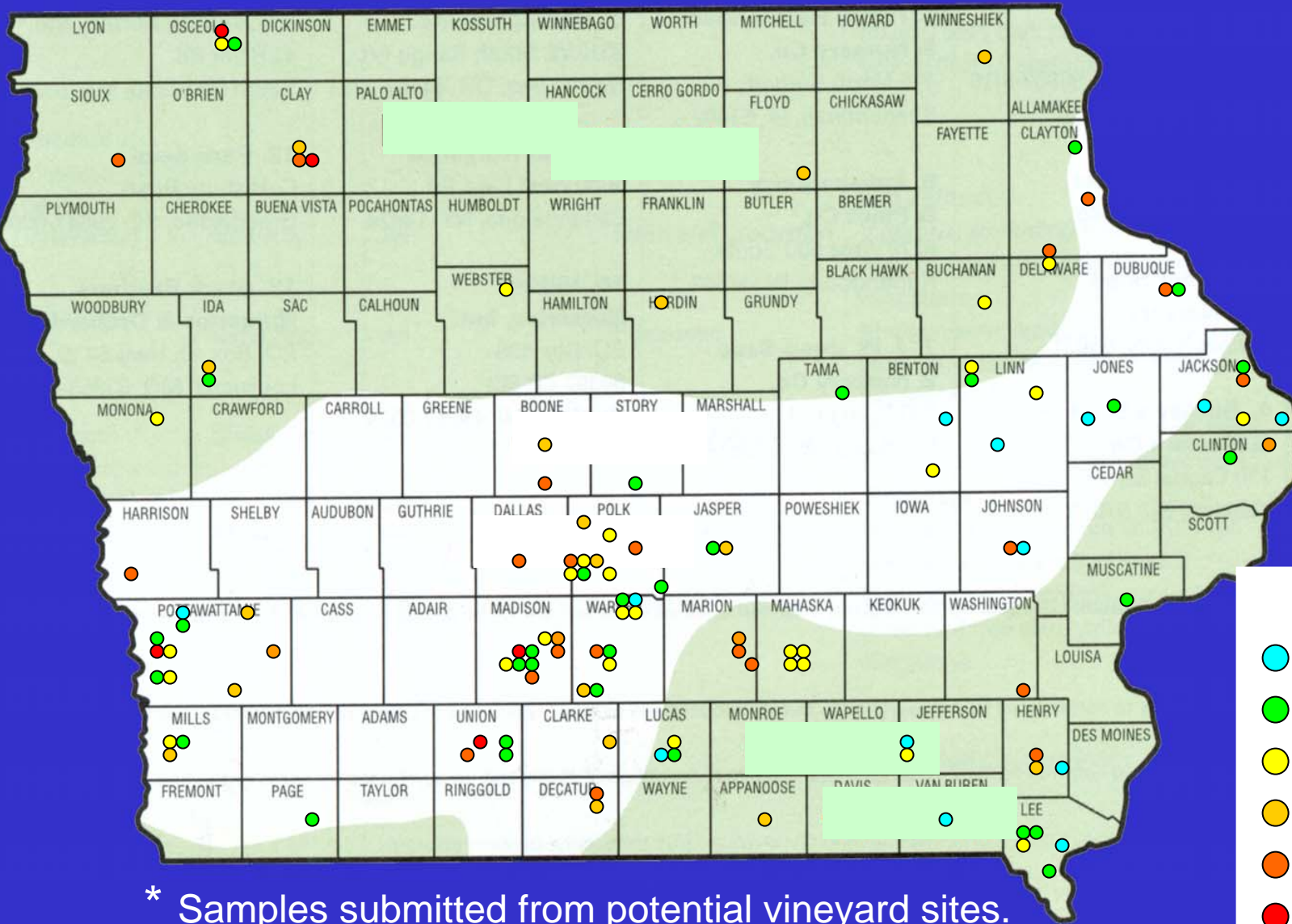
With the indeterminate growth habit of grapes, excessive N promotes vigorous vegetative growth late into the fall, and the inability of the shoots to acclimate for the winter.

**Weighted Average Organic Matter - All Horizons (kg x 100 / sq. m)**



Darker the color, higher the organic matter content.

# Soil Organic Matter \*



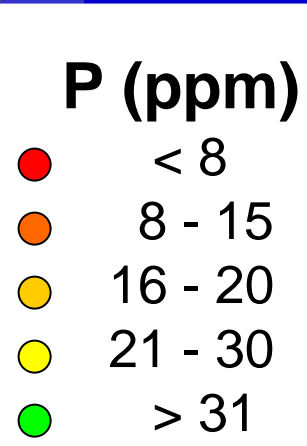
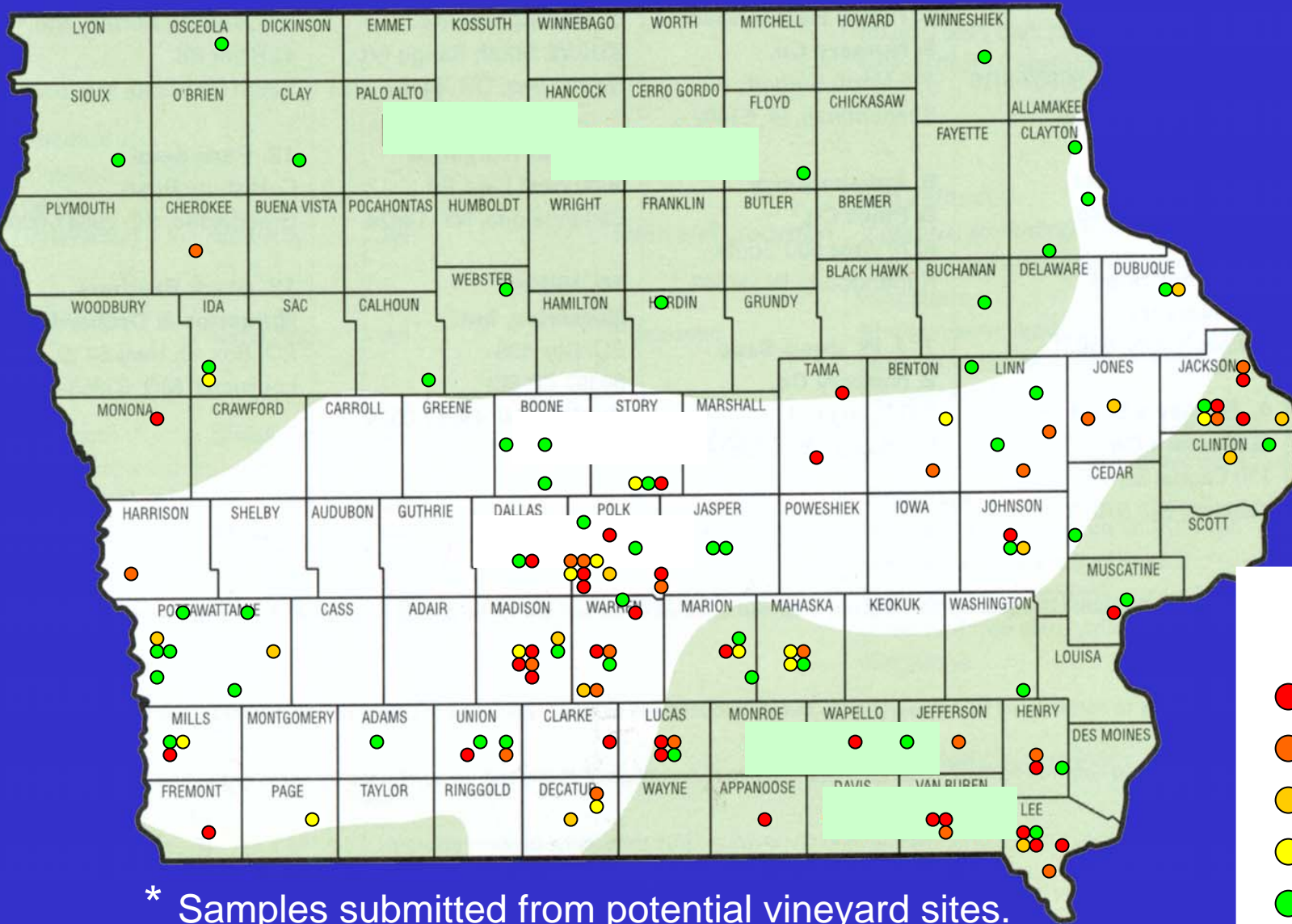
\* Samples submitted from potential vineyard sites.

# Desirable Soil Test Ranges for Grapes

Test	Bul. 861*	Corn / Soybeans
pH	5.5 to 6.5	- -
Organic matter	2 to 3 %	- -
Phosphorous (P)	20 to 50 ppm	30 ppm
Potassium (K)	125 to 150 ppm	150 ppm
Magnesium (Mg)	100 to 125 ppm	- -
Boron (B)	.75 to 1.0 ppm	- -
Zinc (Zn)	4 to 5 ppm	> 1 ppm

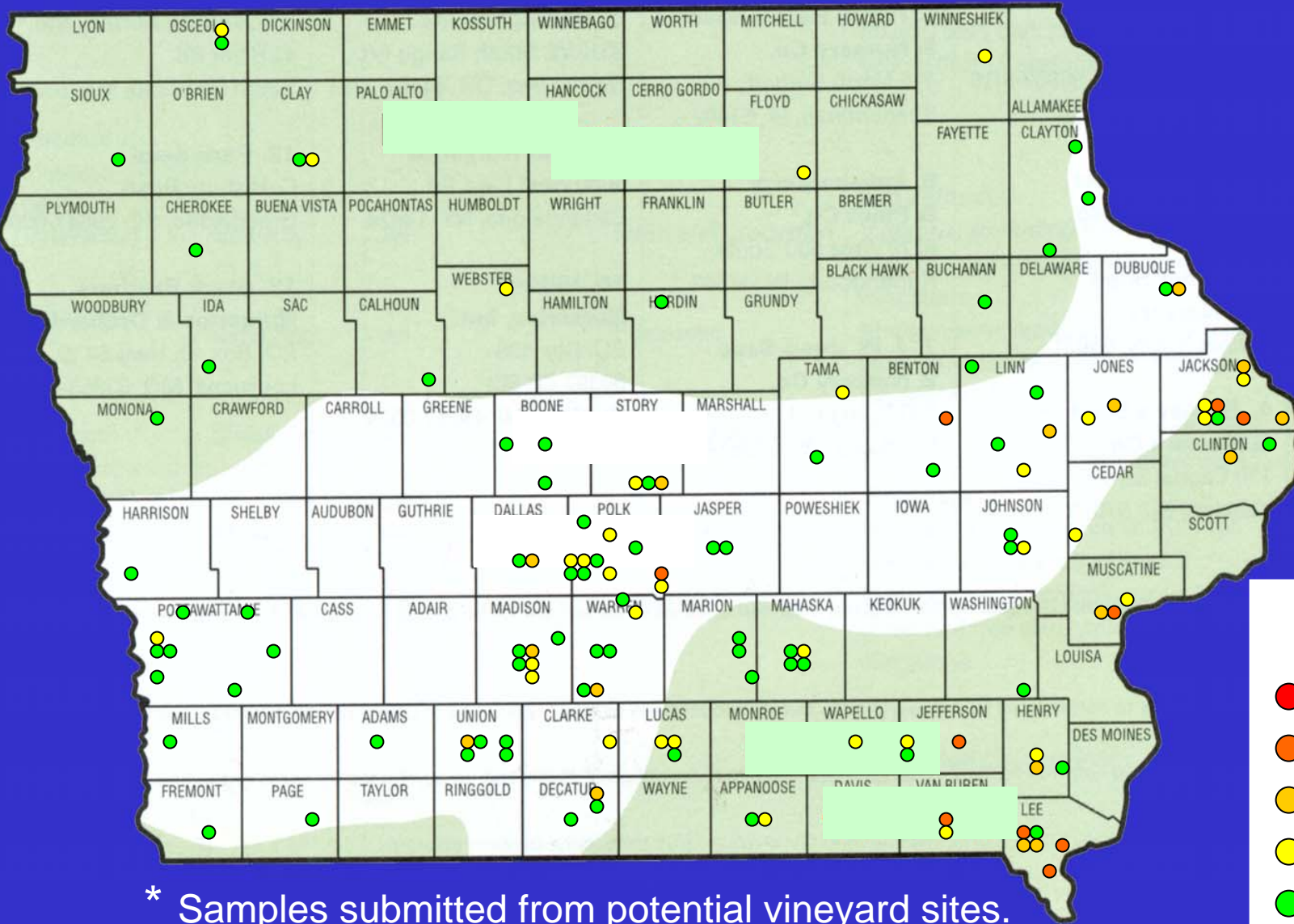
\* Midwest Small Fruit Pest Management Handbook

# Soil Phosphorous (P) \*



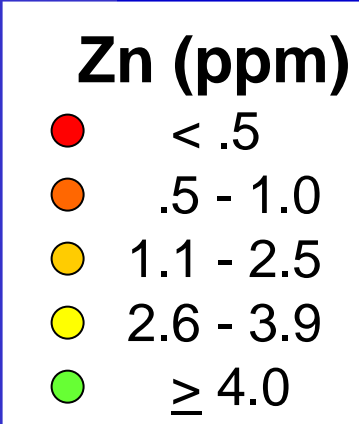
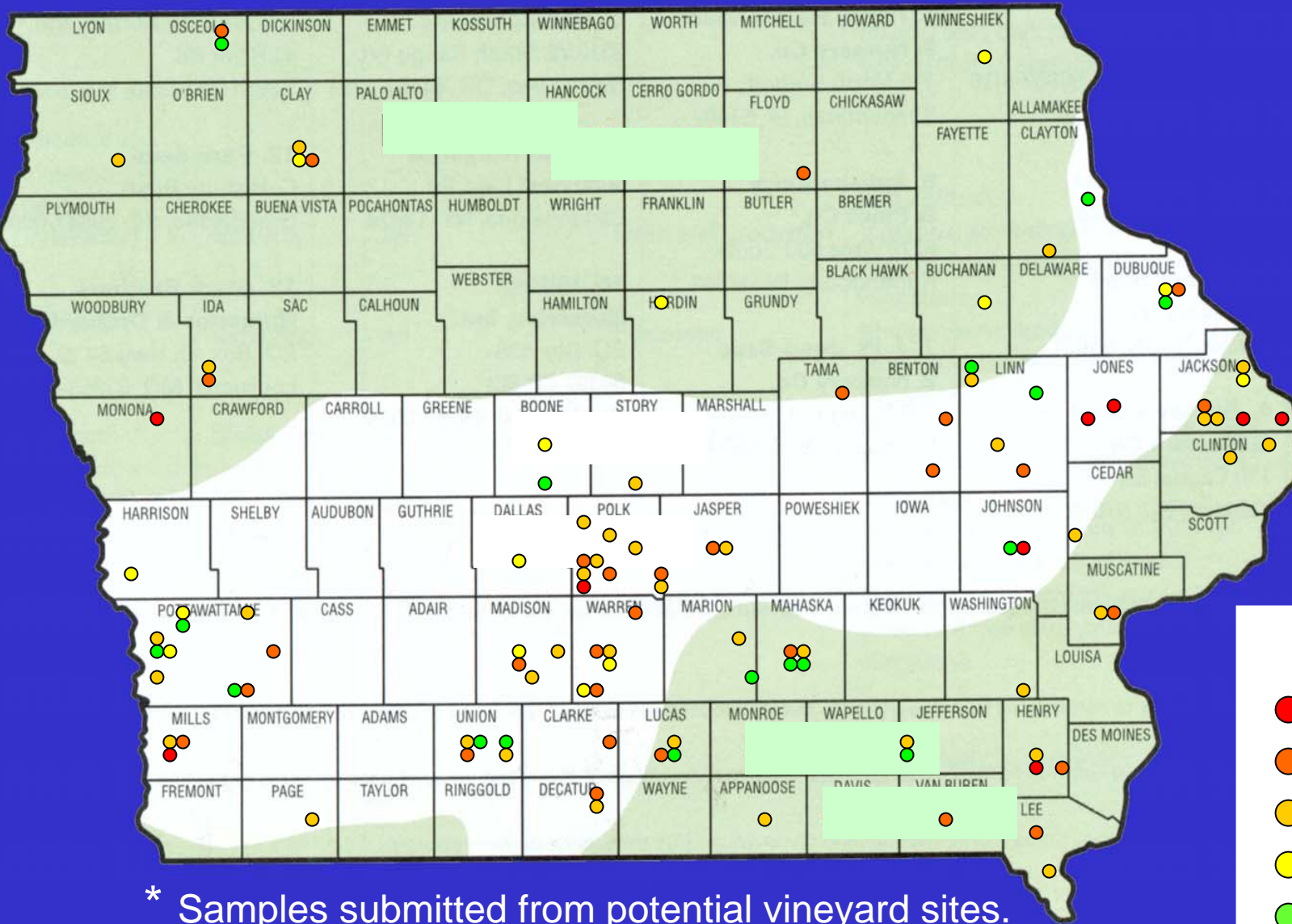
\* Samples submitted from potential vineyard sites.

# Soil Potassium (K) \*



\* Samples submitted from potential vineyard sites.

# Soil Zinc (Zn) \*



\* Samples submitted from potential vineyard sites.

# ISU Soil Testing Laboratory

- **Phone:** (515) 294-3076
- **Web:** <http://www.agron.iastate.edu/soiltesting/>
- **Publication:** ST-11 “Soil sample information sheet for horticultural crops”  
<http://www.extension.iastate.edu/Publications/ST11.pdf>
- **Sampling kits and submission forms (ST-11)**  
Available at County Extension offices

# Nitrogen

the most needed nutrient

Source	Fate
<ul style="list-style-type: none"><li>• Fertilizer</li><li>• Legumes * (Fix up to 300 lb / A / yr)</li><li>• Soil organic matter (Releases ~20 lb / A / % OM / yr)</li><li>• Lightning (Fix ~10 lb / A / yr)</li></ul>	<p><b><u>Lost from Soil:</u></b></p> <ul style="list-style-type: none"><li>• Leaching</li><li>• De-nitrification</li></ul> <p><b><u>Taken up by Plants:</u></b></p> <ul style="list-style-type: none"><li>• Recycled: Leaves &amp; Prunings</li><li>• Removed: Fruit</li><li>• Tied up: Old wood</li></ul>

\* Planting grapes on land that is currently planted with alfalfa is not recommended. Another crop should be planted on the land for a few years to bring down the nitrogen level before planting grapes.

# How Much Nitrogen is Needed?

## Mid-Atlantic Wine Grapegrower's Guide:

- Grapes ~.18% N, Canes ~ .25% N
- **Nitrogen removed:**
  - Grapes: 3.6 lb / A / ton
  - Canes: 1.7 lb / A / lb of prunings / vine
- **For a 3 ton crop & 2 lb prunings / vine:**
  - Grapes: 10.8 lb / A + prunings 3.4 lb / A

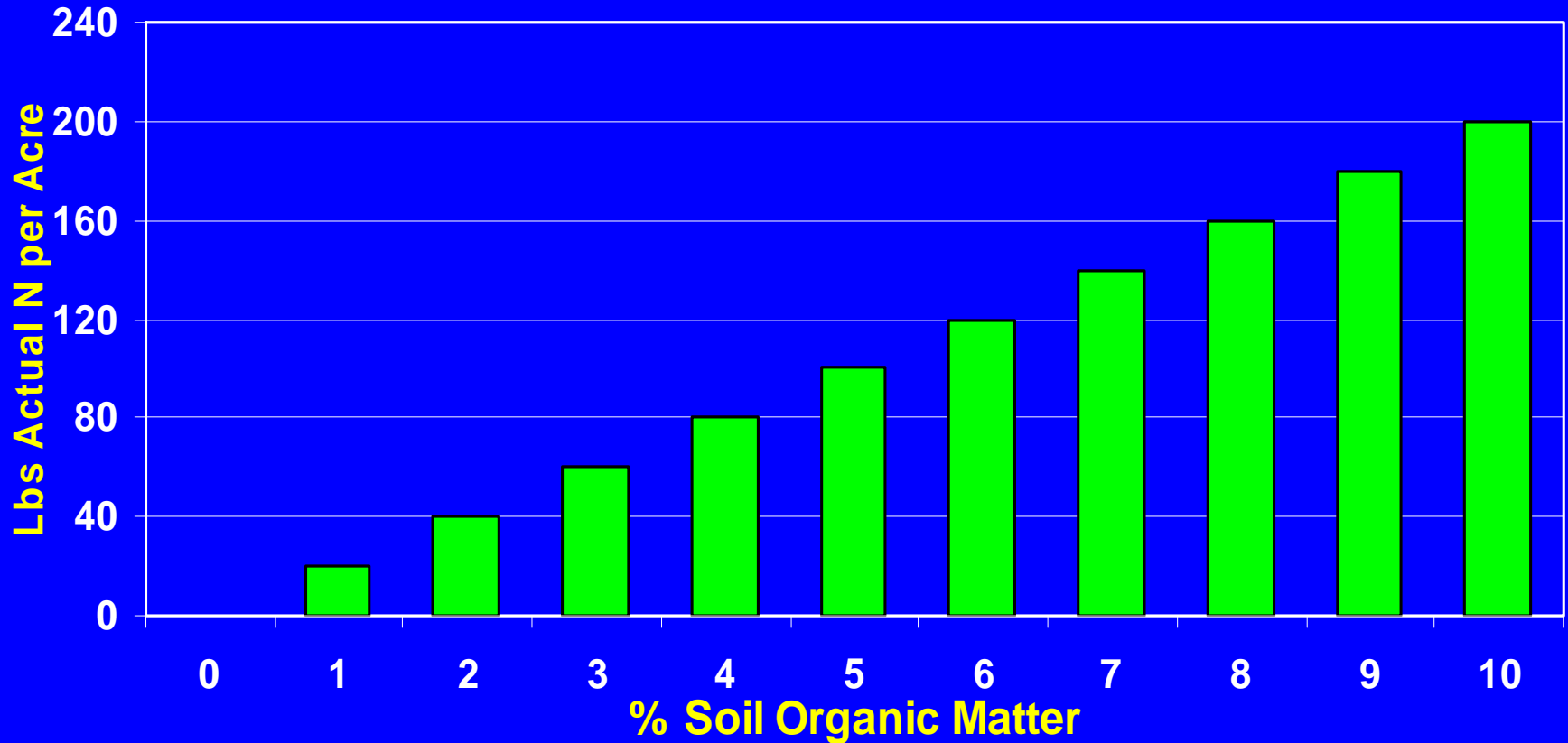
# How Much Nitrogen is Needed?

Cahoon. *Grapes, Production, Management & Marketing*. Ohio State Bul. 815:

“Most vineyards should receive between 40 and 80 pounds of actual nitrogen per year.”

- Sod occupies 2/3's of the land and requires ~ 1 lb N / 1000 sq.ft. (~30 lb / A).
- Grapes are receiving from 10 to 50 lb of N per acre.

# Nitrogen Released from Organic Matter



Need to adjust N fertilization practices based on the organic matter content of your soil.

# Summary of Site Considerations

- Select an elevated site to avoid spring frost & extremely low winter temperatures.
- Select a deep, well-drained soil that has an adequate moisture holding capacity, and does not contain excessive organic matter. Check your County Soil Survey.
- Test the soil before planting for pH, P, K, Zn & organic matter content. Amend the soil as needed.
- Select and plant grape varieties that are adapted to your site regarding winter temperature tolerance, length of growing season, and accumulated growing degree days.

# Summary of Grape Nutrient Management

- Pre-plant Soil Test: pH, P, K, Zn, O.M.
- Amend soil as needed and incorporate as deep & as uniformly as possible.
- Apply a low rate of N after planting, and in 2<sup>nd</sup> year. (40-50 lb N / A - .4 to .6 oz N applied around each vine, & the remainder broadcast applied. Adjust based on soil organic matter content.)
- Begin petiole analysis during the 2<sup>nd</sup> year, and adjust N fertilizer rates based on test results and vine vigor (prunings removed).
- Apply other nutrients as needed based on petiole analysis results.

# Vineyard Economics\*

- **Foch vineyard**

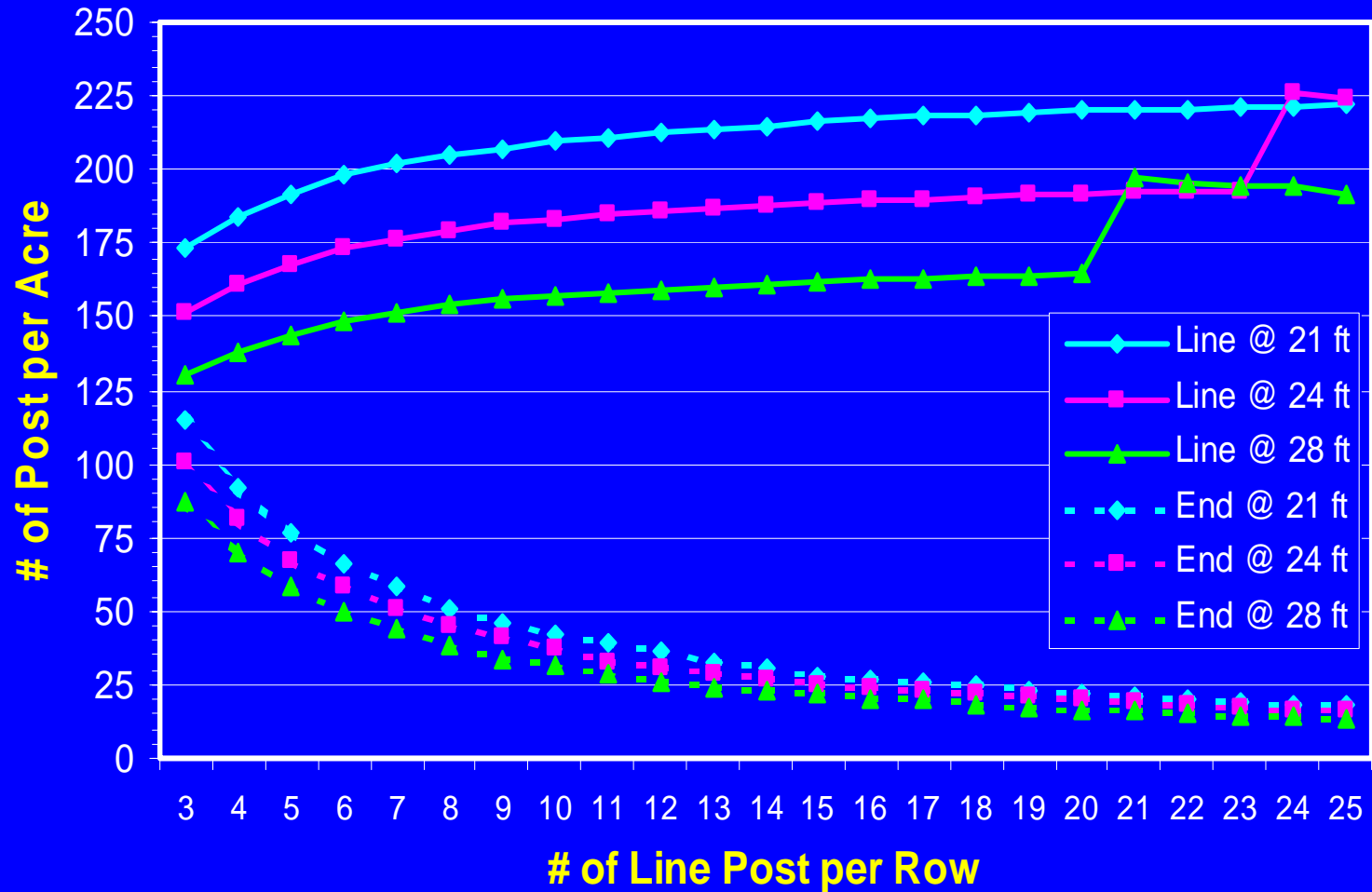
- Moderately vigorous & productive vine
- Spacing: 7 x 9 ft
- Vines (691) @ \$1.75
- Line post @ 28 ft
- Labor @ \$8.00 / hr
- Production potential 3.5 tons / A
- Sell to a winery @ per ton: \$1,000

\*See: *Cost of Establishing a Vineyard in Iowa*, and *Estimated Vineyard Establishment Costs per Acre* under “Other ISU Information”

# Vineyard Establishment Cost

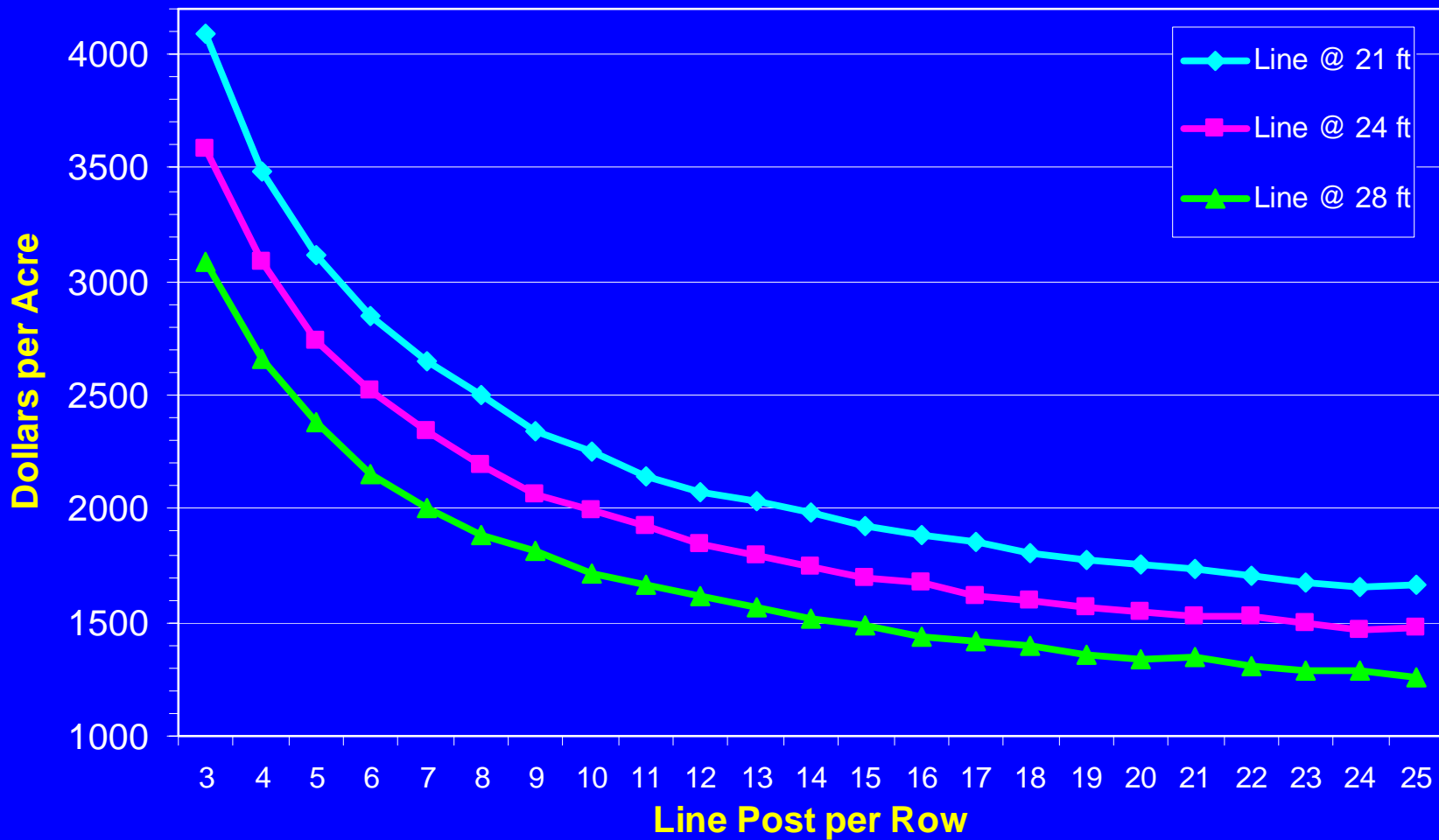
Pre-plant	169.00
Planting: (spacing of 7 x 9 ft)	
Vines (691 @ \$1.75)	1,209.00
Planting expenses (w/ planter)	138.00
Trellising:	
Materials (11 rows, 448 ft long w/ 15 line posts / row @ 28 ft)	1,482.00
Installation	520.00
Cultural expenses	1,022.00
Land charge	120.00
Operating interest @ 8 %	186.00
<b>Total Establishment Cost</b>	<b>\$ 4,846.00</b>

# Number of Post per Acre At a 9 ft Row Spacing



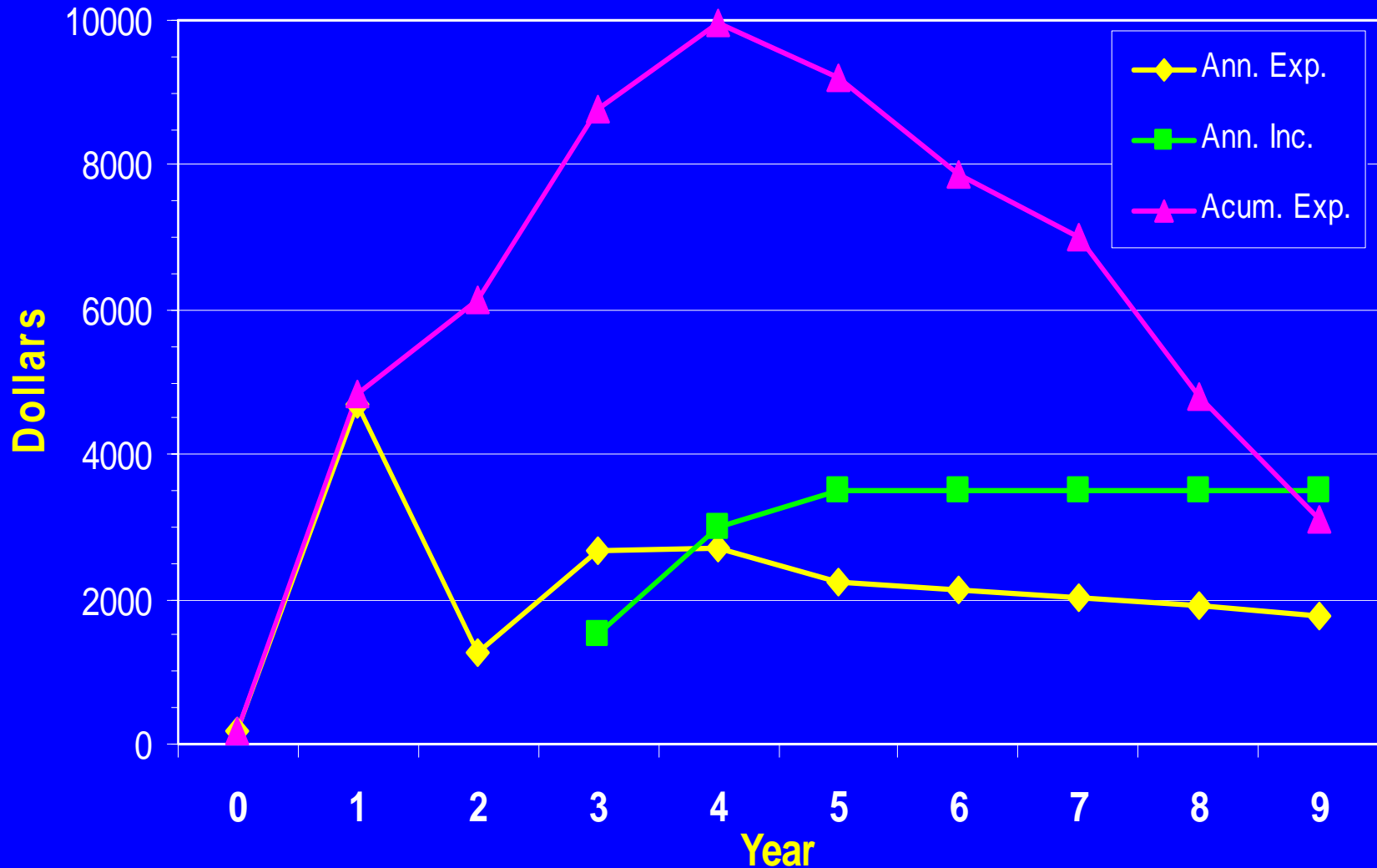
# Trellis Materials Cost per Acre

## Rows 9 ft apart w/ 2 wires



Row length affects the cost of trellis materials because end post can be as much as 3 times more expensive than line posts. Also with more rows per acre, more wire strainers are required.

# Vineyard Budget Analysis



The increase in annual expense in Year 3 and 4 is due to the purchase of harvest containers, and an increased pest control program. The decrease in annual expense from year 4 to 9 is from debt reduction.