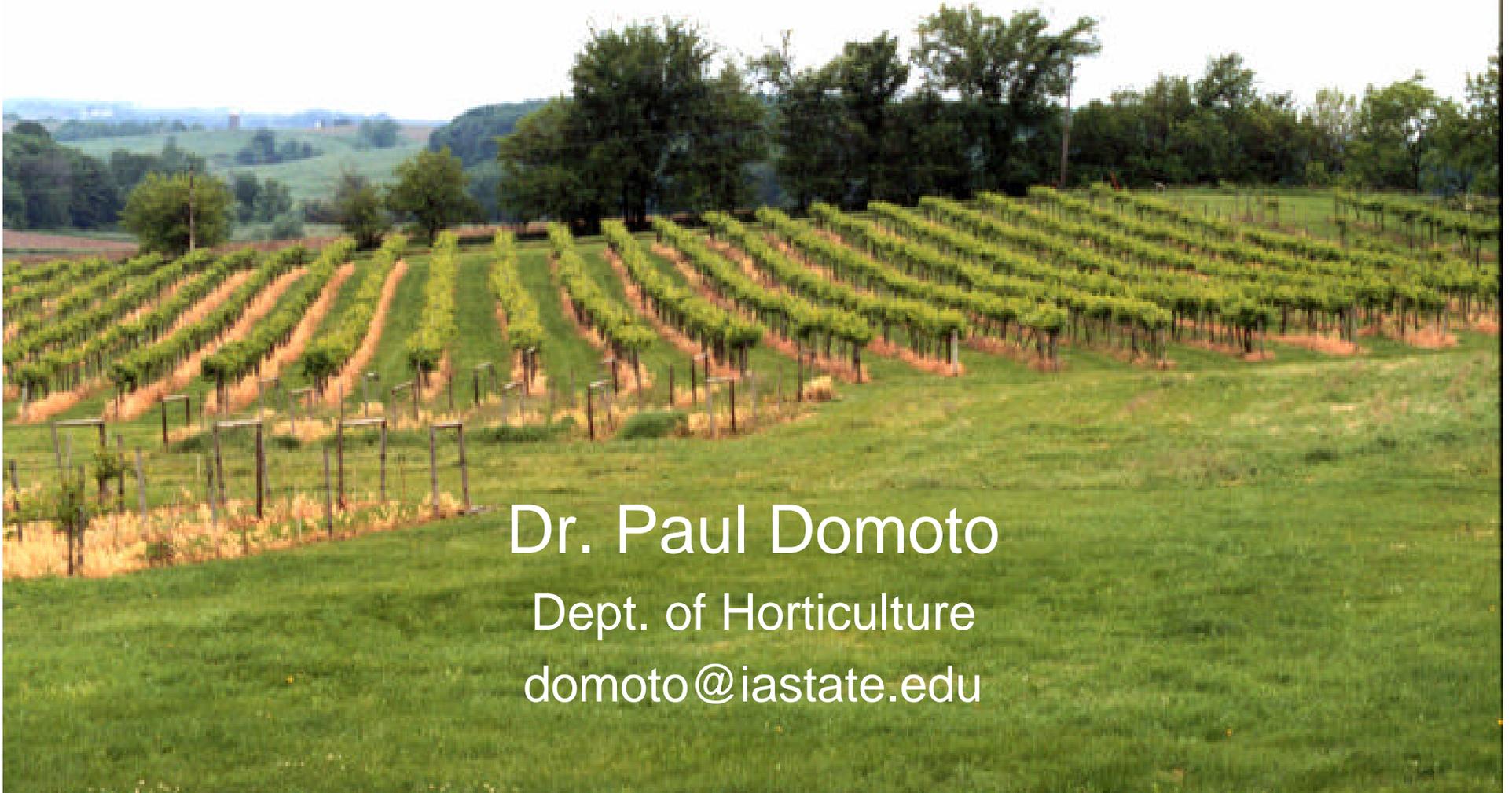


Considering a Vineyard?



Dr. Paul Domoto
Dept. of Horticulture
domoto@iastate.edu

Potential for a new enterprise:

- Determine if your site is suitable for a vineyard.
- Determine if there is a market for grapes in the area.
 - Winery (private, cooperative, or build your own)
 - Other outlets: Farmer markets, grocery stores, hobbyist.
- Select cultivars to plant.
 - Adaptation to your specific conditions.
 - Use (wine, table, juice, jam & jellies) & demand.
- Plant the vines, establish trellis & begin training.
 - Financing
- Develop a good management program.
 - Time available
 - Cultural practices

Is your site suitable for grapes?

Climate	Topography	Soils
<ul style="list-style-type: none">• Winter Temperatures *• Spring Frosts• Length of Growing Season• Growing Degree Days• Precipitation	<ul style="list-style-type: none">• Elevation• Degree of Slope• Direction of Slope• Nearness to a large body of water	<ul style="list-style-type: none">• Drainage• Moisture Holding Capacity• pH• Fertility• Organic Matter

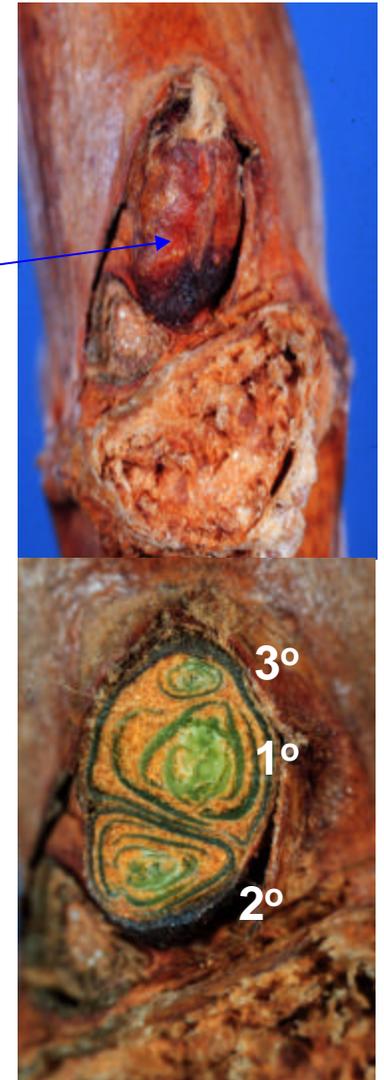
* The most important climatic consideration

Winter Temperatures

Determine what cultivars can be grown & how productive they will be.

Cane buds are the most tender portion of a grape vine.

- **A compound bud with the potential to produce 3 or more shoots.**
 - **1° bud: The most productive.**
 - **2° bud: Less productive; varies with type & cultivar.**
 - American types 50% or less productive
 - French hybrids 60-80% as productive.
 - **3° bud: Very un-productive**



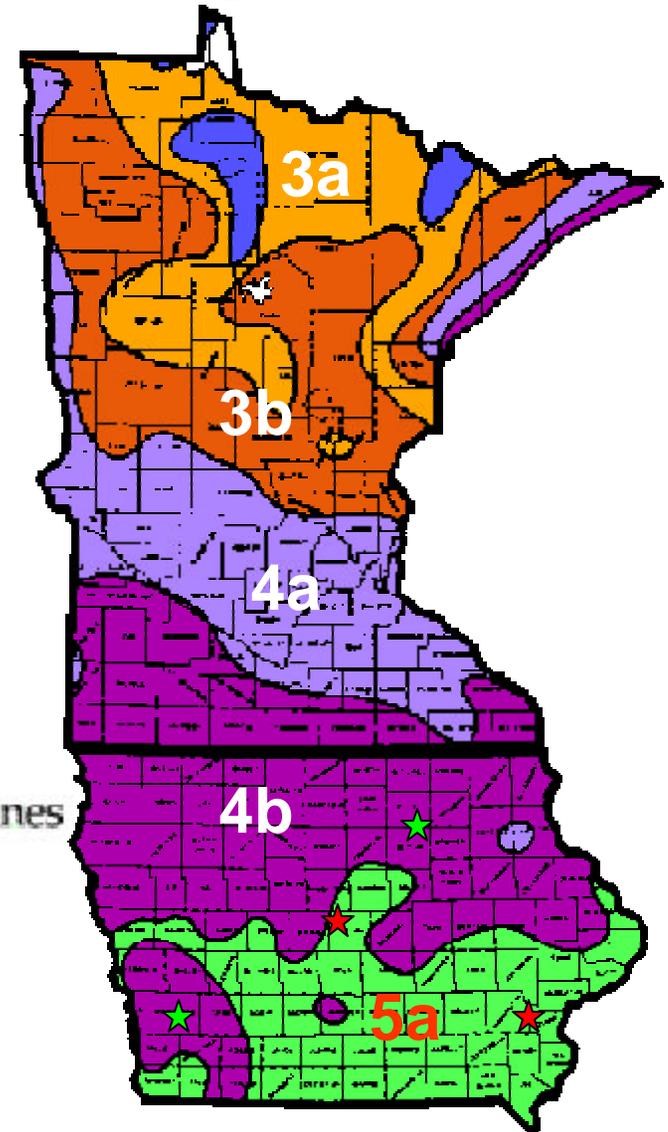
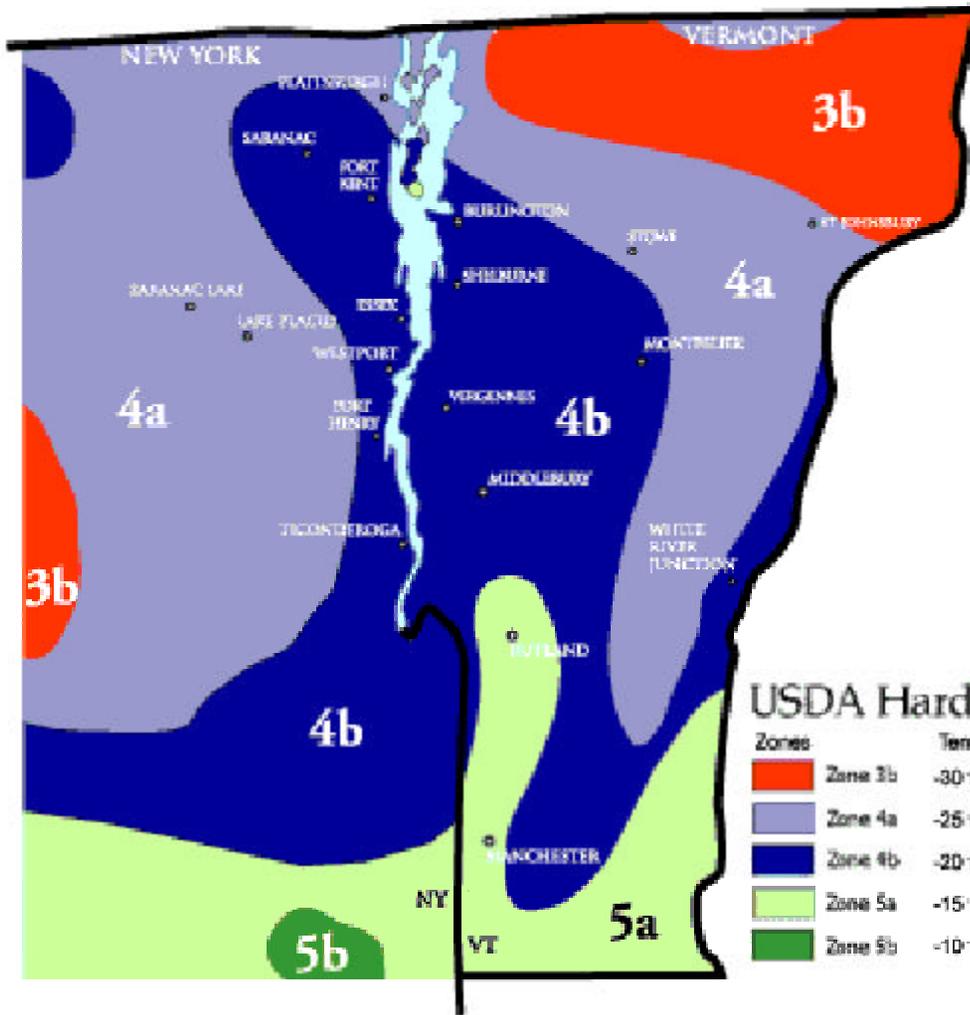
Classification of Vine Hardiness

Based on the temperature at which injury begins to occur

Temp. (F°)	Category	Suitable Type
≥ 0	Very cold tender	Almost any.
- 5	Cold tender	Most northern <i>vinifera</i> .
- 10	Moderately Hardy	Hardy <i>vinifera</i> , moderately hardy French hybrids.
- 15	Hardy	Hardy French hybrids, most <i>labrusca</i> .
$\leq - 20$	Very hardy	Hardy <i>labrusca</i> , most <i>riparia</i> hybrids.

USDA Hardiness Zone Map

PLANT HARDINESS ZONES IN VERMONT AND NEW YORK



Grape Cultivar Adaptation

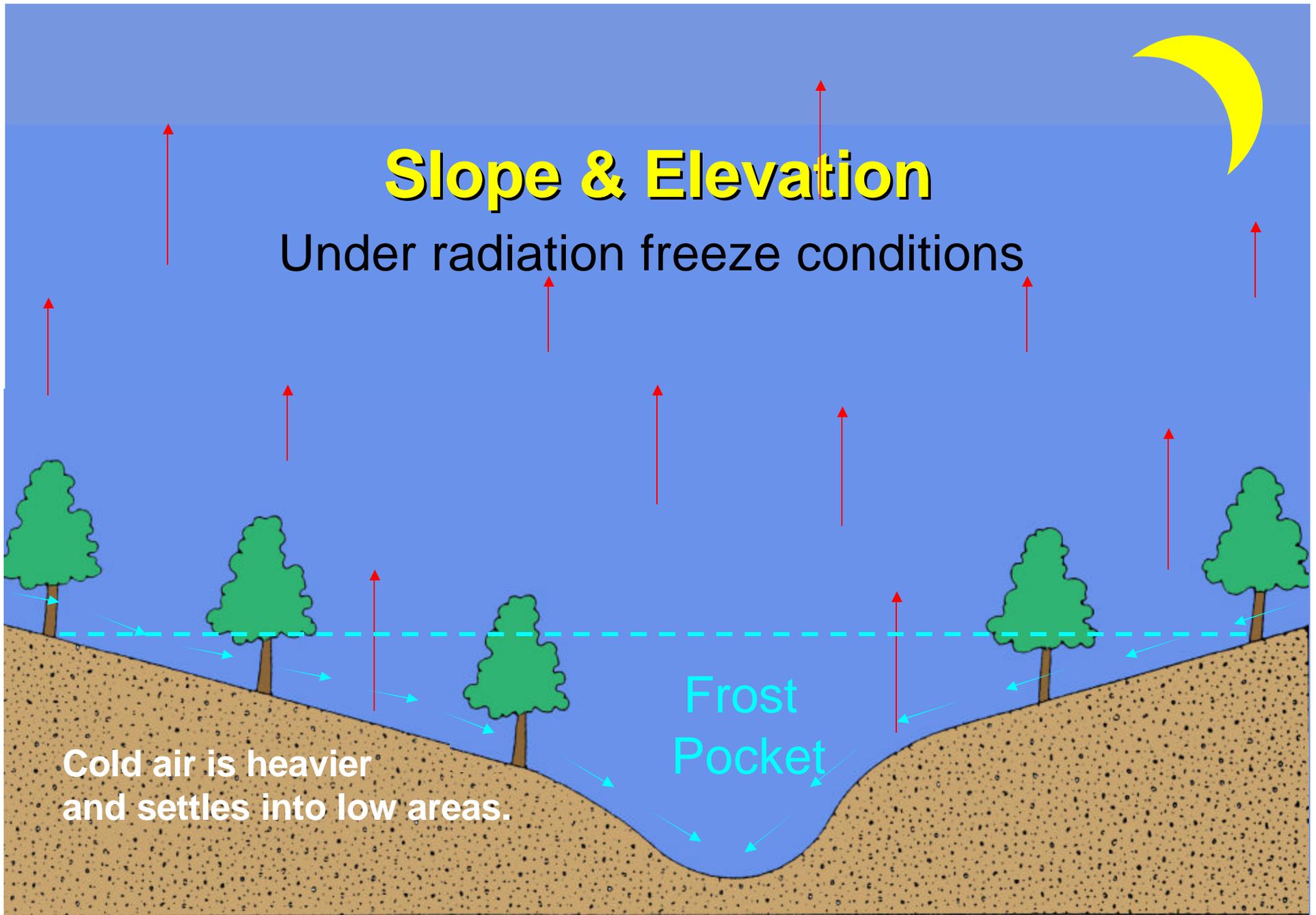
Harvest Season:	Early			Mid			Late		
Climatic Zone:	5A	4B	4A	5A	4B	4A	5A	4B	4A
Cold tender (-5)	T?	N	N	T?	N	N	N	N	N
Mod. Hardy (-10)	T	T?	N	T	T?	N	T?	N	N
Hardy (-15)	Y	T	T?	Y?	T	T?	T	T?	N
Very Hardy (-20)	Y	Y	T	Y	Y?	T	Y?	T	T?

Y = Should be adapted.
 Y? = Testing may be required
 T = Testing is required

T? = Adaptability questionable,
 may not warrant testing.
 N = Not adapted.

Slope & Elevation

Under radiation freeze conditions



Length of the Growing Season

Frost-Free Days	Suitability for Grapes
< 150	Unacceptable
150 to 160	Marginal: Only early season maturing varieties.
160 to 170	Satisfactory: Early & most mid-season maturing varieties.
170 to 180	Good: Early, mid-season & some late-season varieties.
> 180	Excellent: Most varieties.

Is often very site specific.

ISU Armstrong R&D Farm Vineyard

Elevation:

- Reduces the risk of spring & fall frosts.
- Extends the growing season.
- Protection from low winter temperatures.





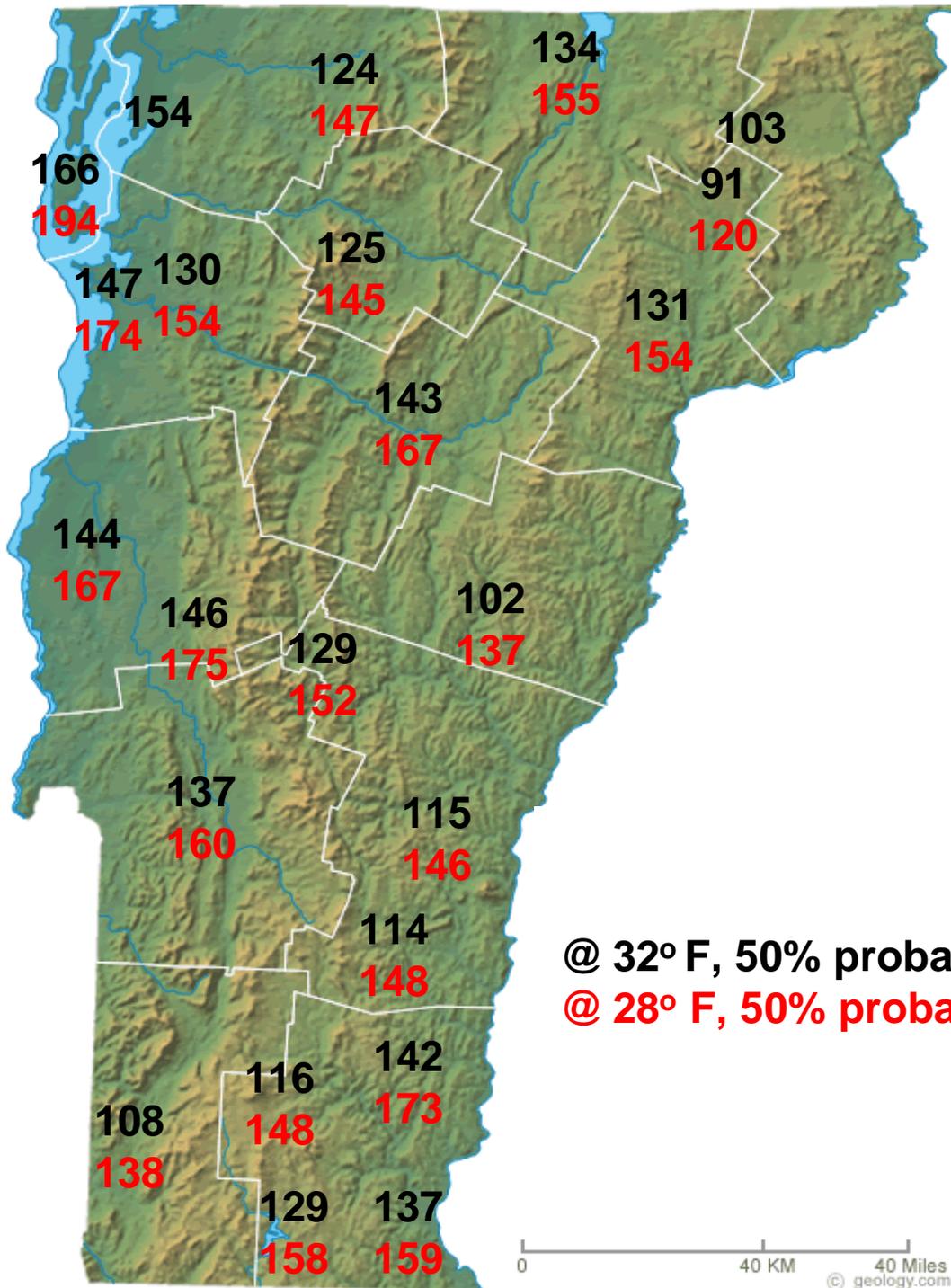
Length of the Growing Season

Elevation reduces the risk of spring & fall frosts.

- Cold air drainage.

Large bodies of water moderate the temperature.

- Delay warming up in the spring.
- Extend the growing season in the fall



Frost Free Days

@ 32° F, 50% probability
 @ 28° F, 50% probability

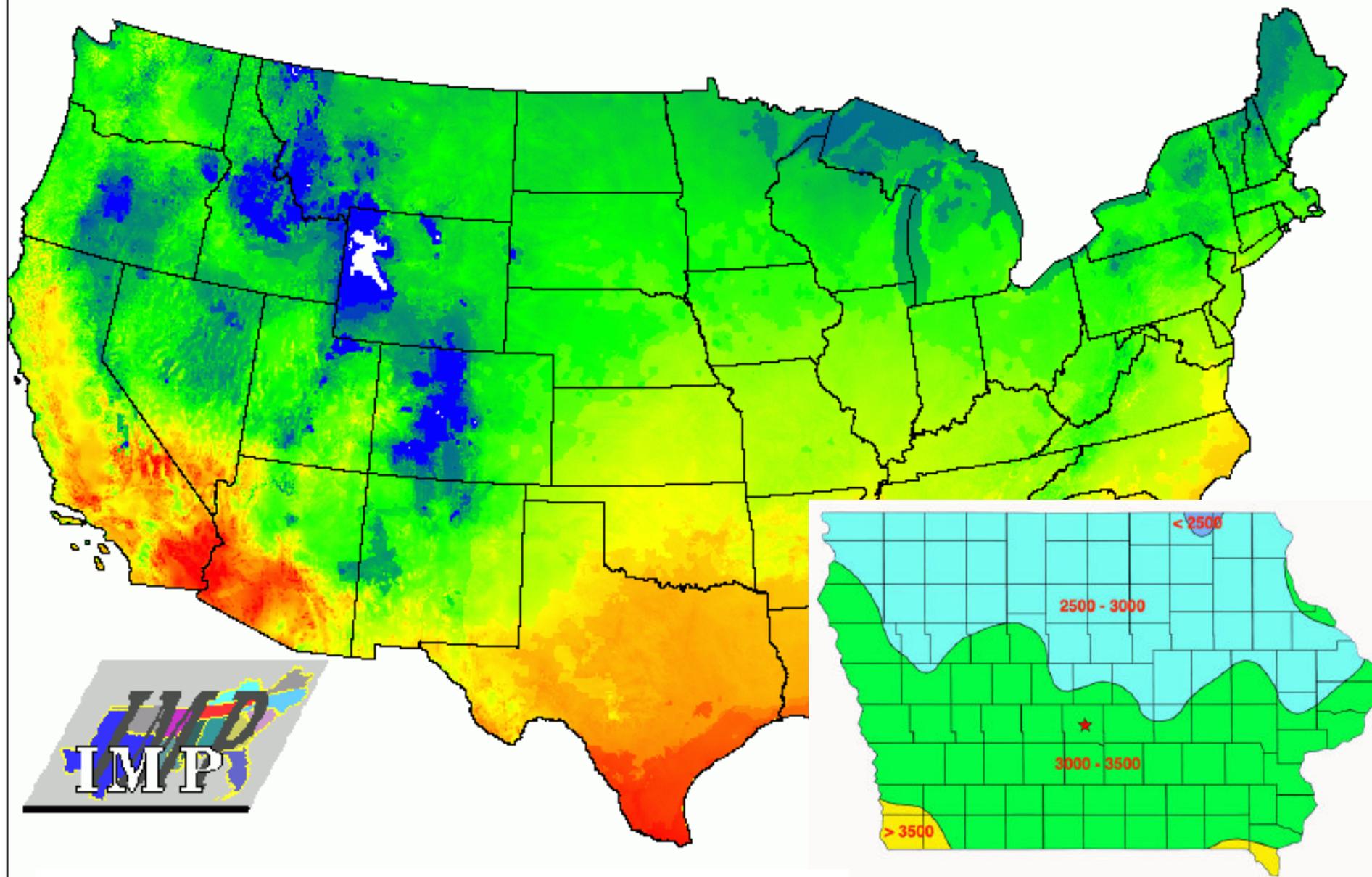


Growing Degree Days (Winkler)

Region	Degree Days*	Suggested Varieties
I	$\leq 2,500$	Early ripening varieties to achieve high quality.
II	2,501 to 3,000	Early and mid-season table varieties.
III	3,001 to 3,500	High production of standard to good quality table wines.
IV	3,501 to 4,000	High production, but table wine quality will be acceptable at best.

* Base 50° F; Degree day = ((daily high + low) / 2) – 50

Degree Days Heat Sum Above 5.55 C During Growing Season



<http://www.geobabble.org/~hnw/esri98/P33318.GIF>

Precipitation



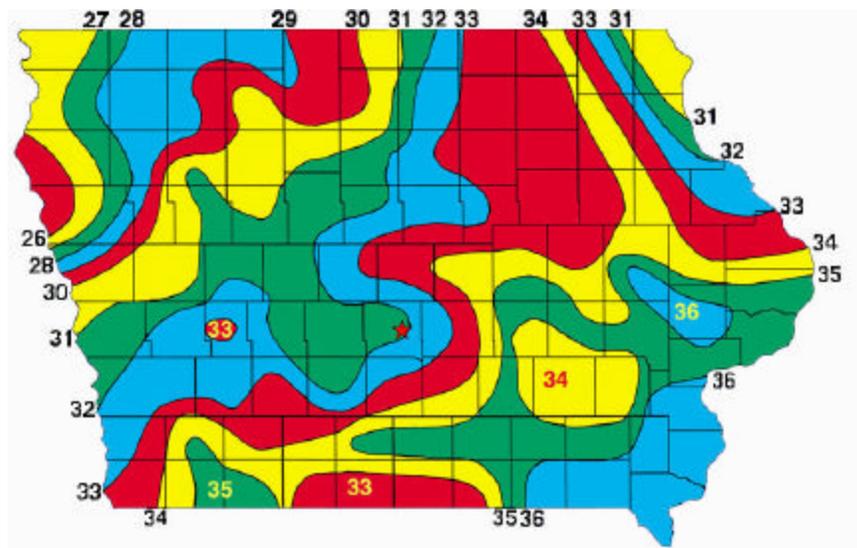
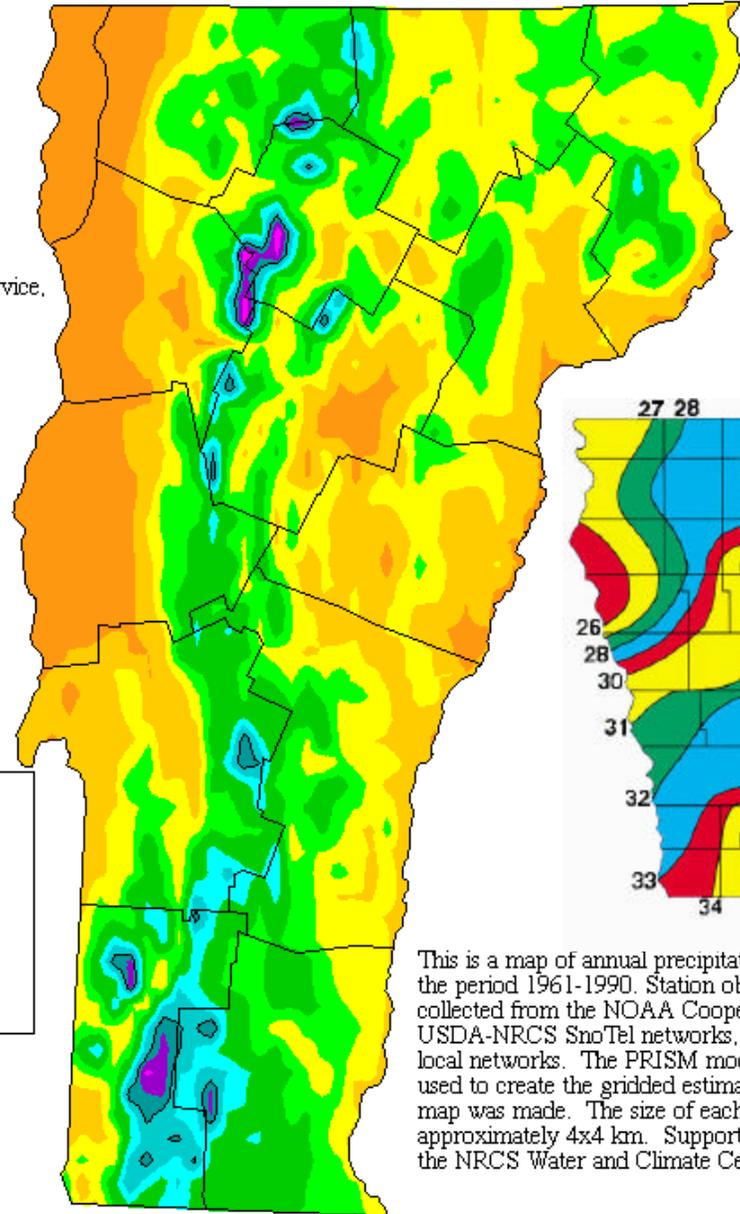
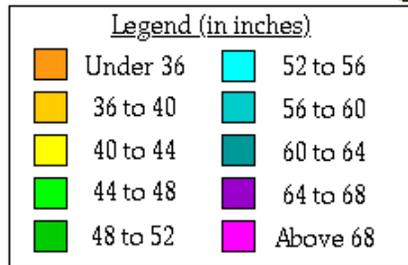
1-inch per week

- Varies with:
 - a. Frequency of rain fall
 - b. Rooting depth of the crop
 - Grapes are deep rooted.
 - c. The soil's moisture holding capacity.
 - Soil Texture
 - Soil depth
 - d. Temperature, relative humidity, & wind as they affect transpiration.
 - e. How the soil surface is maintained.

Average Annual Precipitation

Vermont

Copyright 2000 by Spatial Climate Analysis Service,
Oregon State University



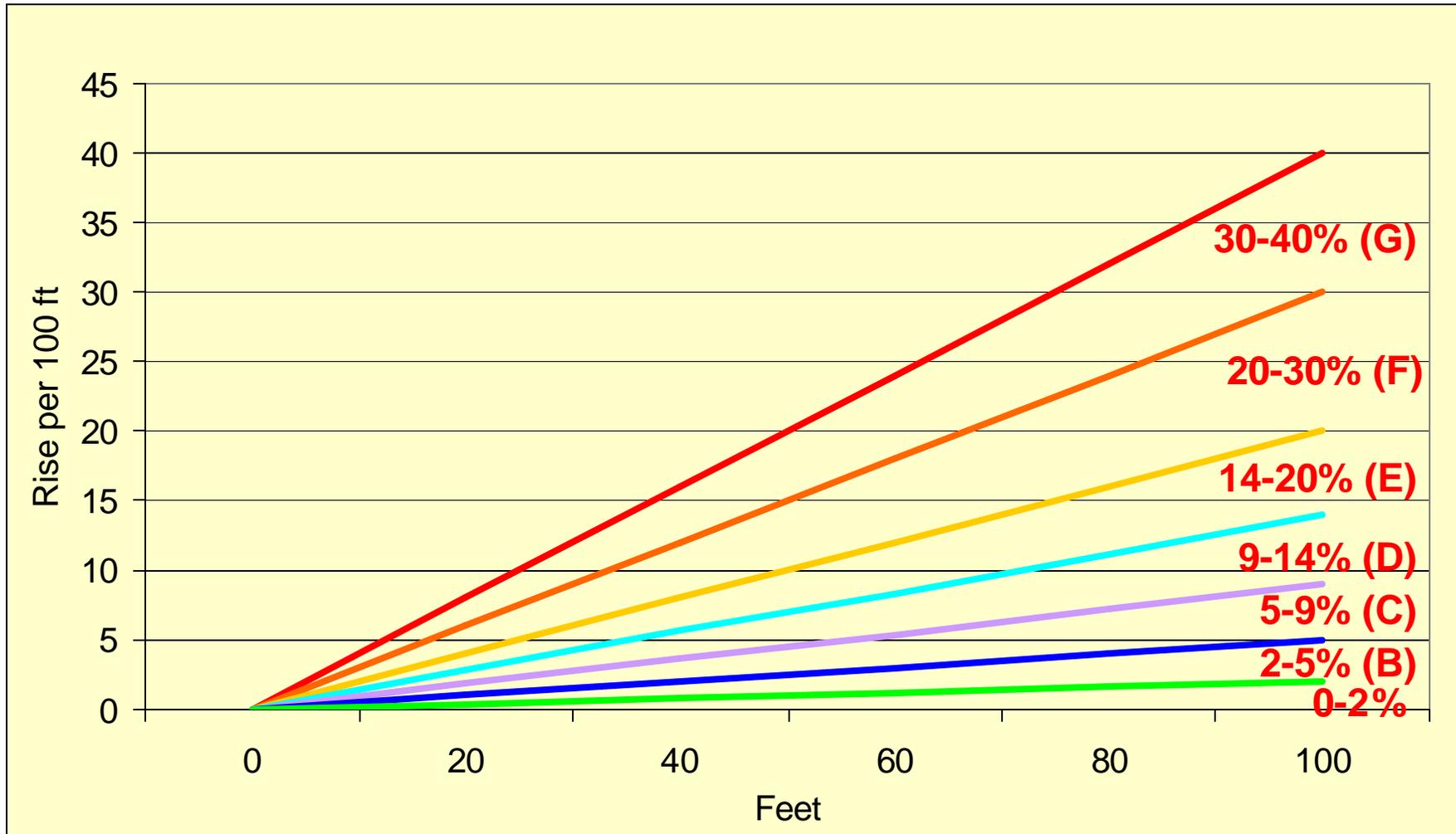
This is a map of annual precipitation averaged over the period 1961-1990. Station observations were collected from the NOAA Cooperative and USDA-NRCS SnoTel networks, plus other state and local networks. The PRISM modeling system was used to create the gridded estimates from which this map was made. The size of each grid pixel is approximately 4x4 km. Support was provided by the NRCS Water and Climate Center.

<http://www.ocs.orst.edu/pub/maps/Precipitation/Total/States/VT/vt.gif>

Degree of Slope

- Soil moisture
 - Infiltration
 - Surface runoff
- Air drainage of frost protection.
- Soil erosion
- Cultural practices

% Slope



Soils with “B”, “C” and “D” slopes are best suited for grapes.

Direction of the Slope

Growing Condition	N	S	E	W
Available Sunlight	Lowest	Highest	Int. +	Int. -
Accumulation of Heat Units	Lowest	Highest	Int. -	Int. +
Need for Water	Lowest	Highest	Int. -	Int. +
Risk of a Spring Frost	Lowest	Highest	Int. -	Int. +
Risk of Fluctuating Winter Temperatures	Lowest	Highest	Int. -	Int. +

If the length of the growing season is marginal for a cultivar, select a south facing slope.

Soil Selection Factors

- Internal Drainage
- Moisture Holding Capacity
 - Texture
 - Depth
- pH
- Fertility

County Soil Surveys

- 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 Internal Drainage Classification

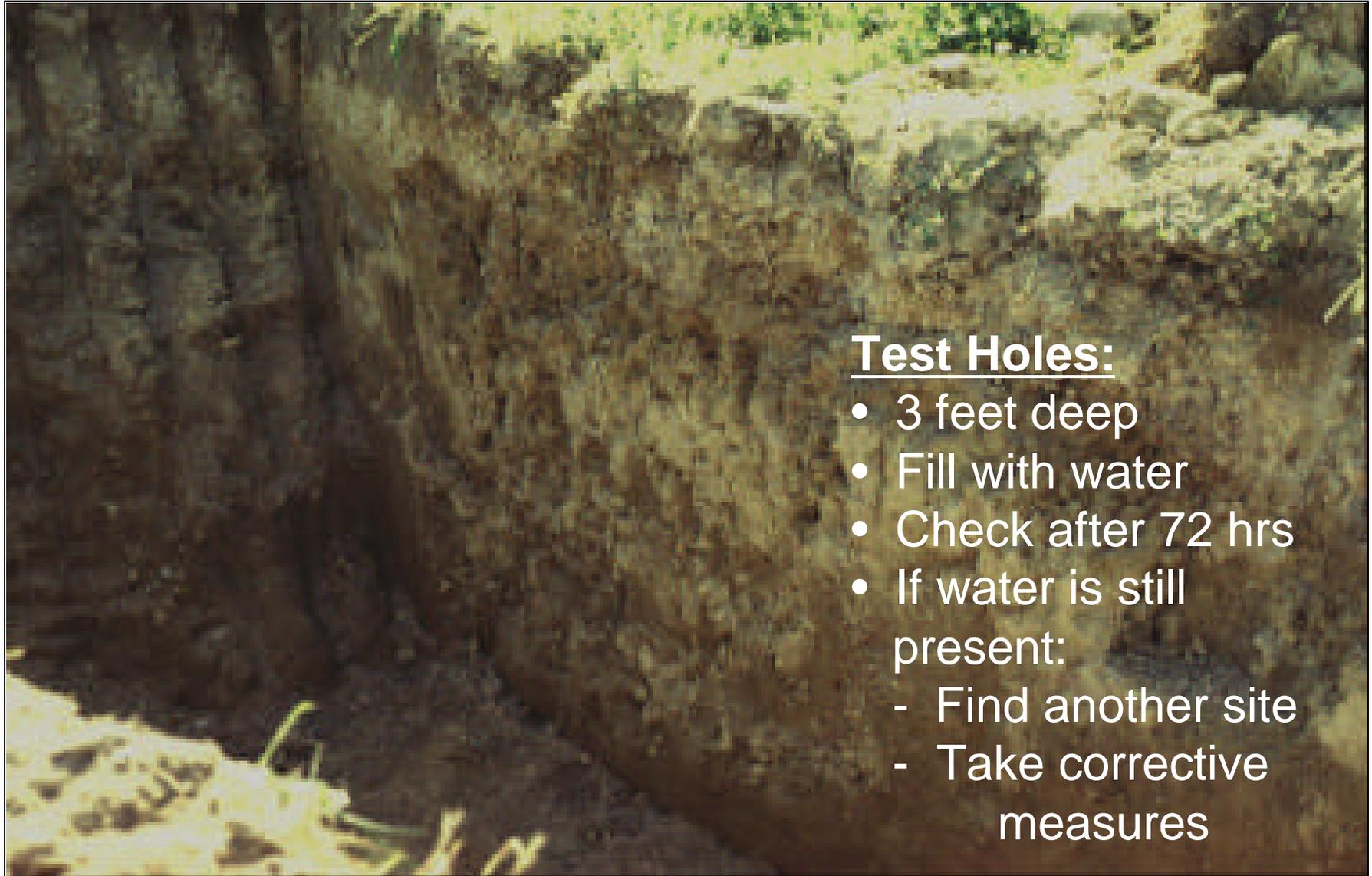
Very poorly drained	AVOID
Poorly drained	Avoid
Somewhat poorly drained	Marginal
Moderately well-drained	Suitable
Well-drained	Ideal
Excessively drained	Marginal

Always best to dig test holes to check the 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

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

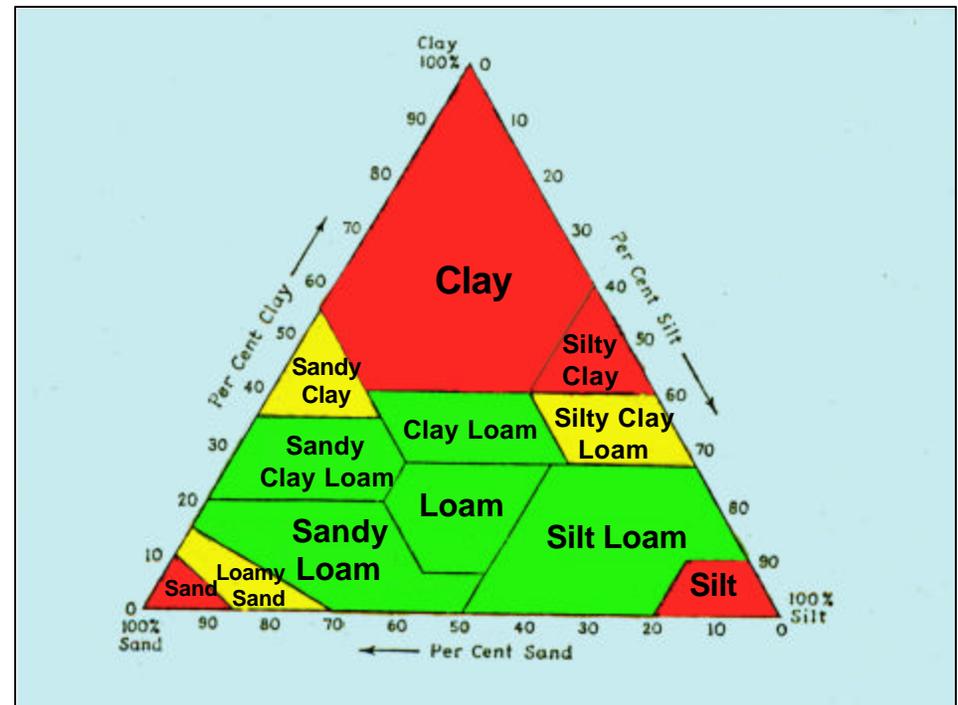
- **Sub-soil before planting**
 - Effective for compacted soils if there is good soil below.
- **Plant on raised beds**
 - Suitable on moderately well drained soils.
 - Maybe okay for somewhat poorly drained soils.
- **Install drainage tile**
 - Suitable for somewhat poorly drained soils.
 - Maybe okay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

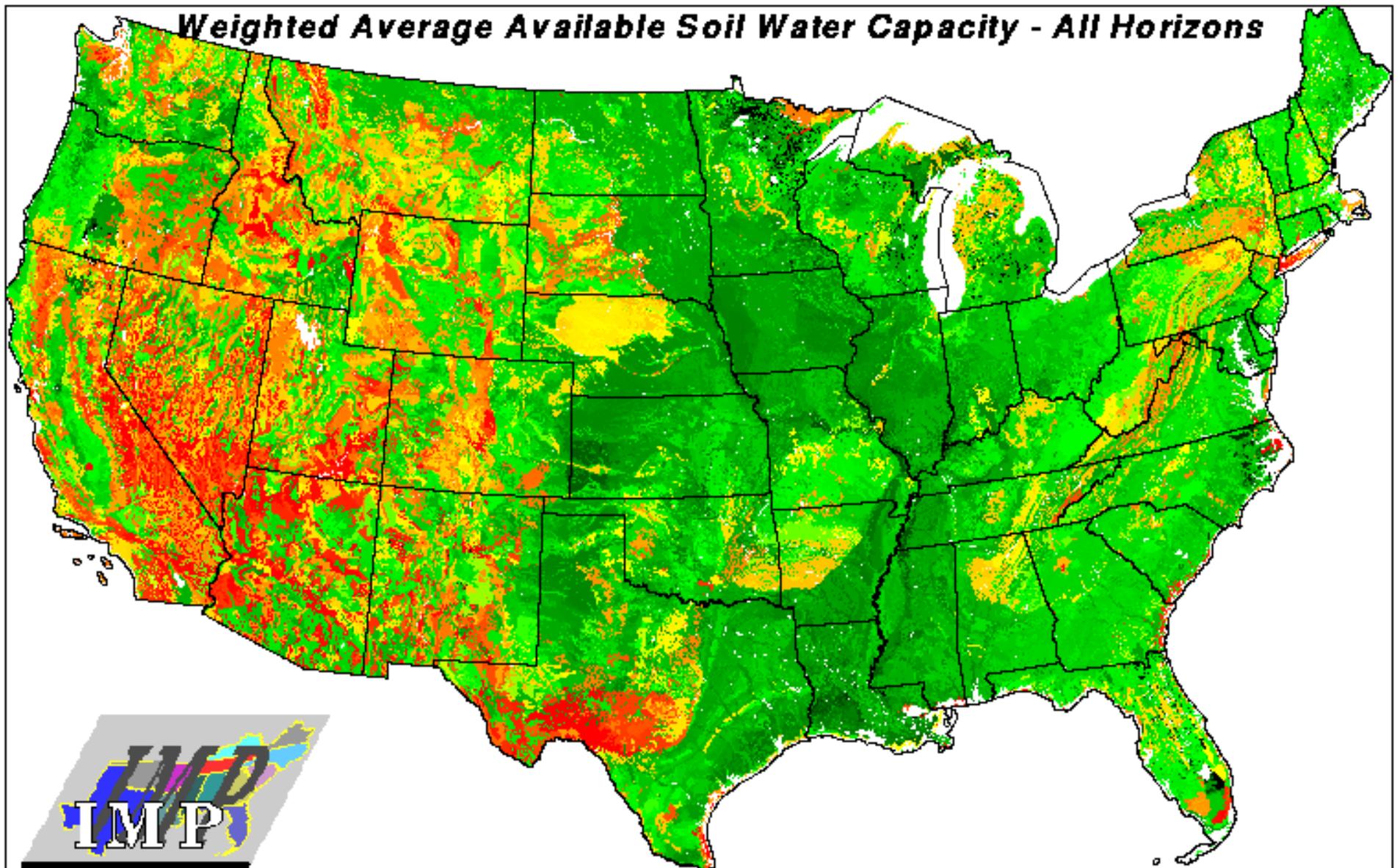
Moisture Holding Capacity

Soil Texture + Soil Depth

Available Moisture

Texture	Inches Per foot
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



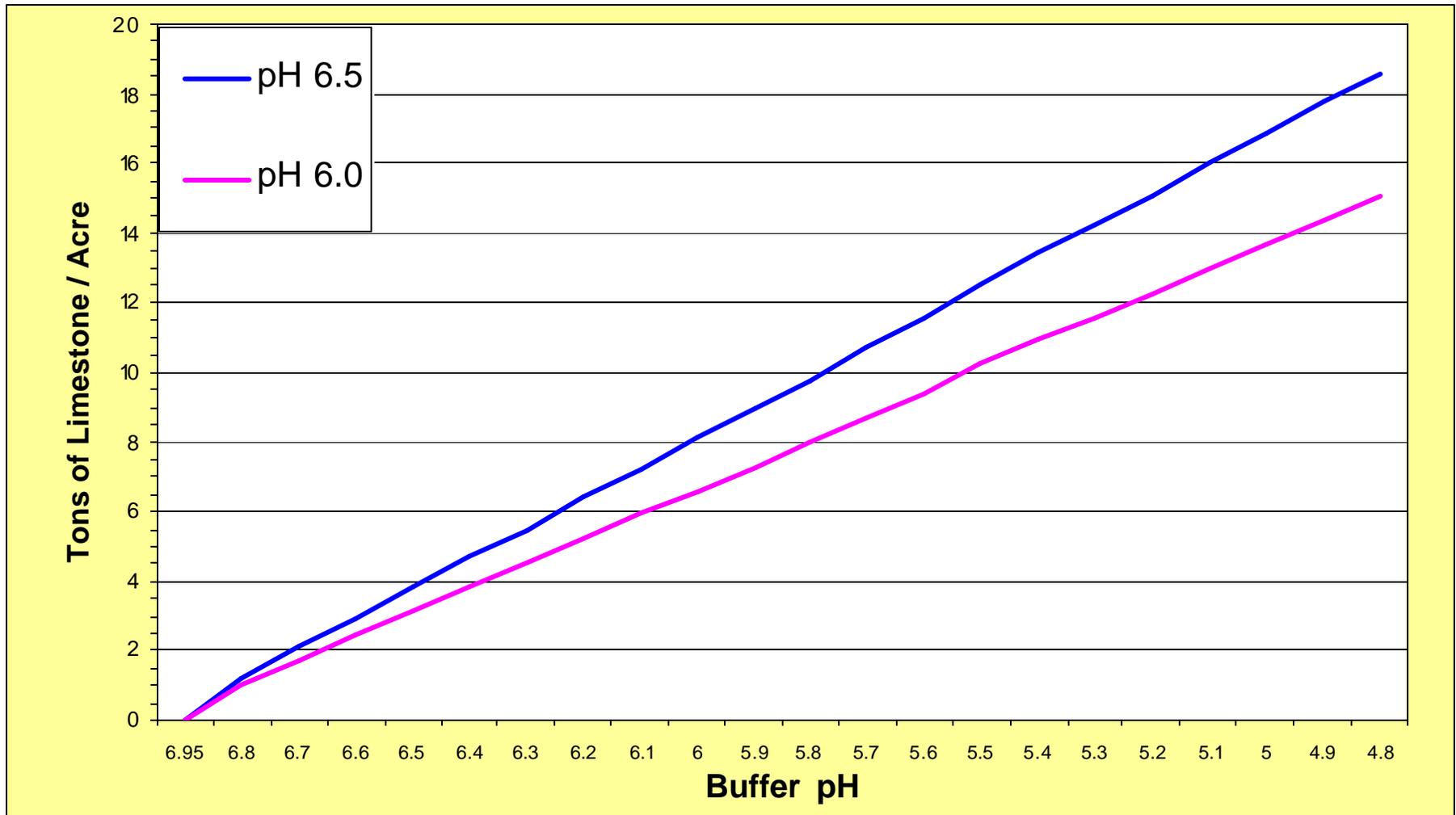


<http://www.geobabble.org/~hnw/esri98/P33308.GIF>

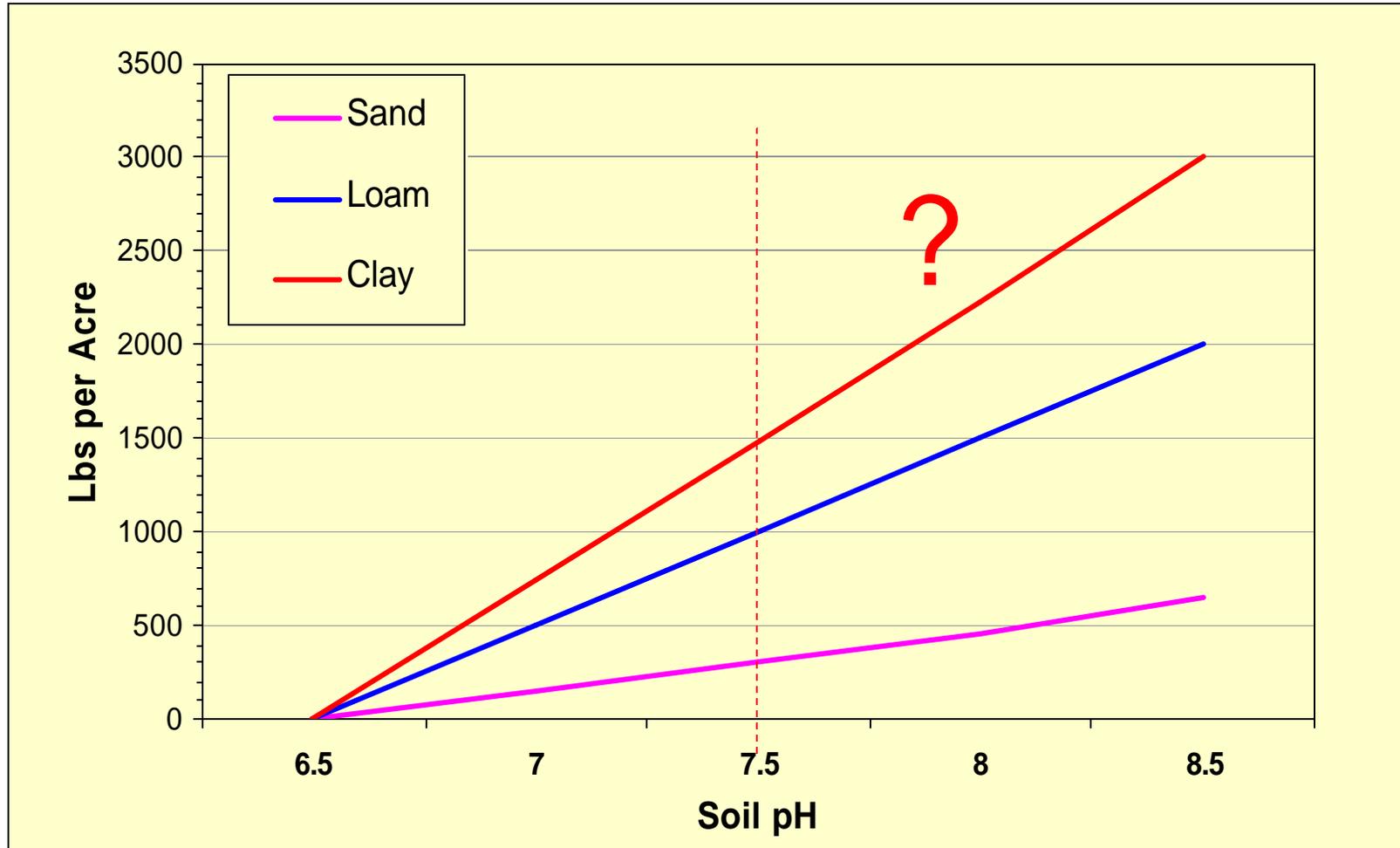
Soil pH for Grapes

- **Desired range: 5.5 to 6.5**
 - American: 5.0 to 6.5 (~ 6.0 optimum)
 - French Hybrid: 5.5 to 6.5; (6.0 to 6.5 optimum)
 - **Will tolerate a pH up to ~ 7.0**
- **Adjust Soil pH:**
 - Below 6.0: bring up to 6.0 or 6.5 with lime.
 - Above 6.8 or 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



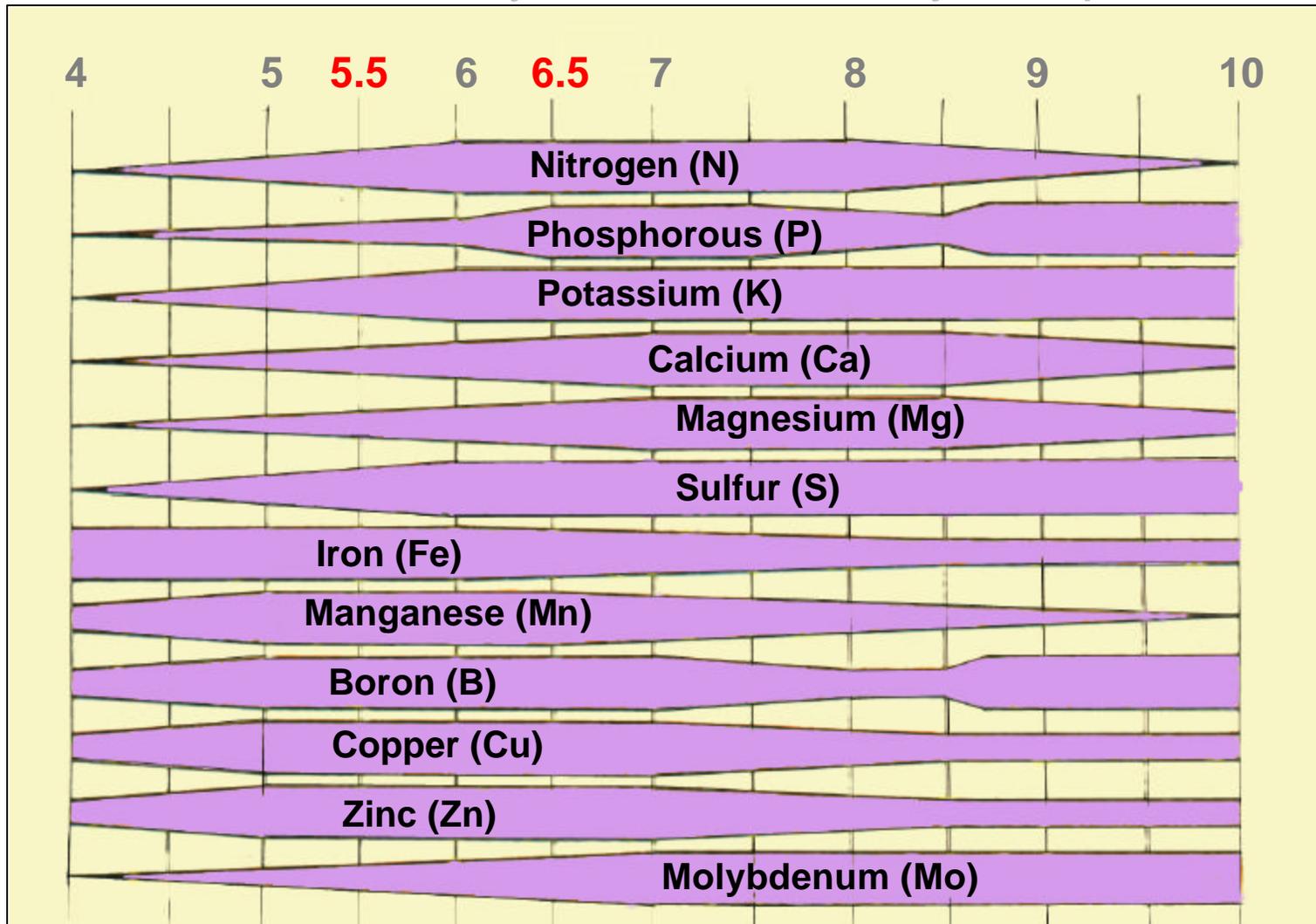
Sulfur Requirement to Reduce the Soil pH to 6.5



Lbs sulfur required to adjust the top 8 inches of soil.

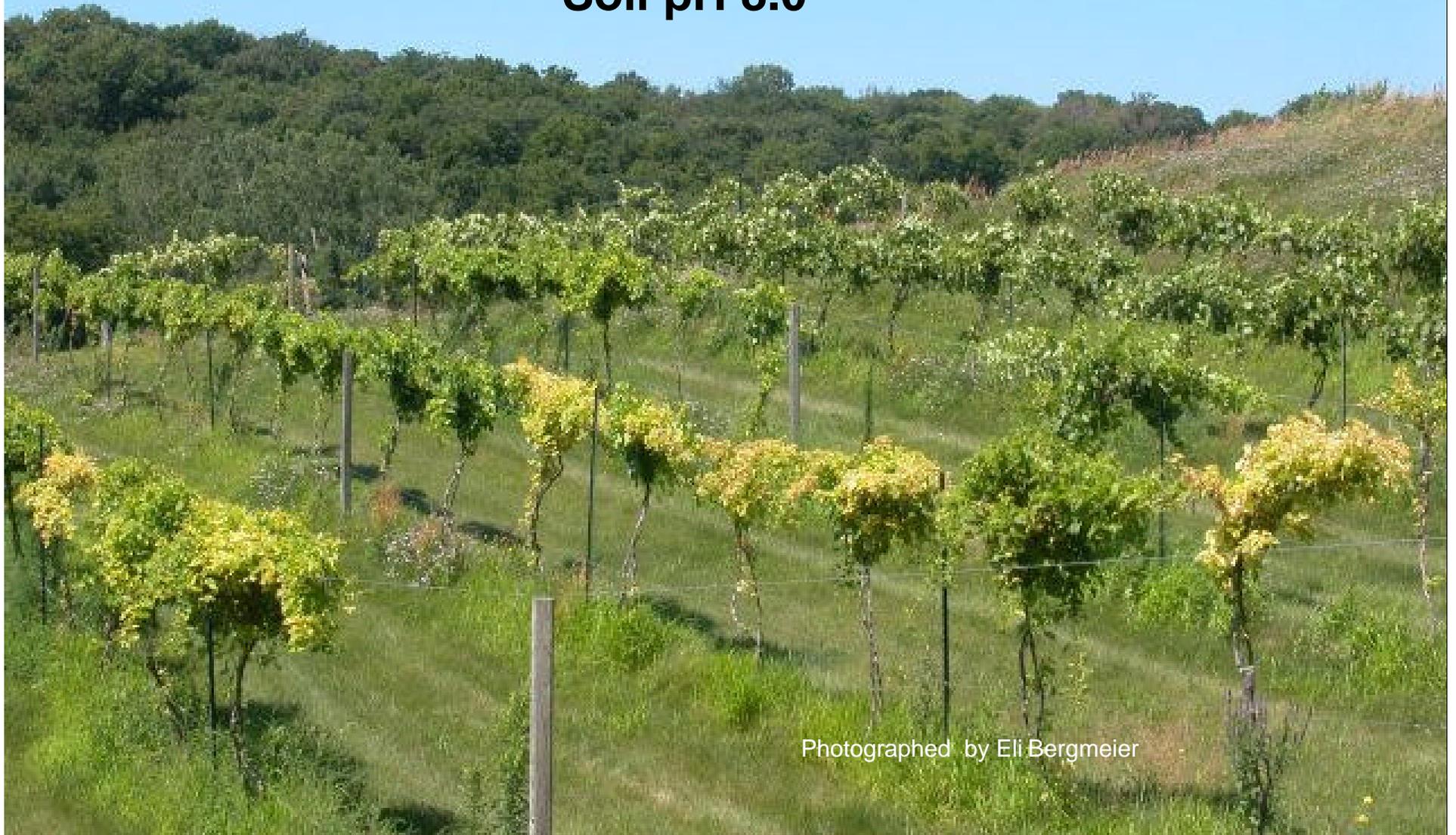
Soil pH

Nutrient Availability as Influenced by Soil pH



Iron Chlorosis

Soil pH 8.0



Photographed by Eli Bergmeier

Soil Fertility

- **Least concern when selecting a site.**
 - Can amend the soil.
- **Concerns:**
 - **P** Immobile in the soil.
 - Pre-plant application is the only economical chance to correct a shortage.
 - Often high where manure has been applied.
 - **K** Grapes have a high requirement for K.
 - Can stratify where cultivation is not practiced as in a vineyard.
 - Excessive soil Mg can inhibit the uptake of K.
 - **Mg** Can be low in many eastern soils, particularly on sandier soils.
 - Uptake of Mg can be inhibited where K has been over-applied.
 - **Zn** Grapes have a relatively high requirement for Zn.

Pre-plant Soil Test

- Test for: **pH, P, K, Zn, Mg, O.M.**
- Submit serial samples collected from 2 depths:
 - 0 to 6 or **0 to 8** inch depth.
 - 6 to 12 or **8 to 16** inch depth.

Desirable Soil Test Ranges for Grapes

Test	Bul. 861*	ISU	U of MN	U of VT
pH	5.5 to 6.5	6.0 to 6.5	6.0 to 7.0	✓
Organic matter	2 to 3 %	2 to 3 (4) %	--	✓
Phosphorous (P)	20 to 50 ppm	> 30 ppm	> 25 ppm	✓
Potassium (K)	125 to 150 ppm	> 150 ppm	> 150 ppm	✓
Calcium (Ca)	--	--	> 600 ppm	✓
Magnesium (Mg)	100 to 125 ppm	100 to 125 ppm	~ 100 ppm	✓
Boron (B)	.75 to 1.0 ppm	--	> 1 ppm	✓
Zinc (Zn)	4 to 5 ppm	4 to 5 ppm	> 1 ppm	✓
Manganese (Mn)	--	--	> 6 ppm	✓
Copper (Cu)	--	--	> 0.2 ppm	✓
Iron (Fe)				✓
Sulfur (S)				✓

* Midwest Small Fruit Pest Management Handbook

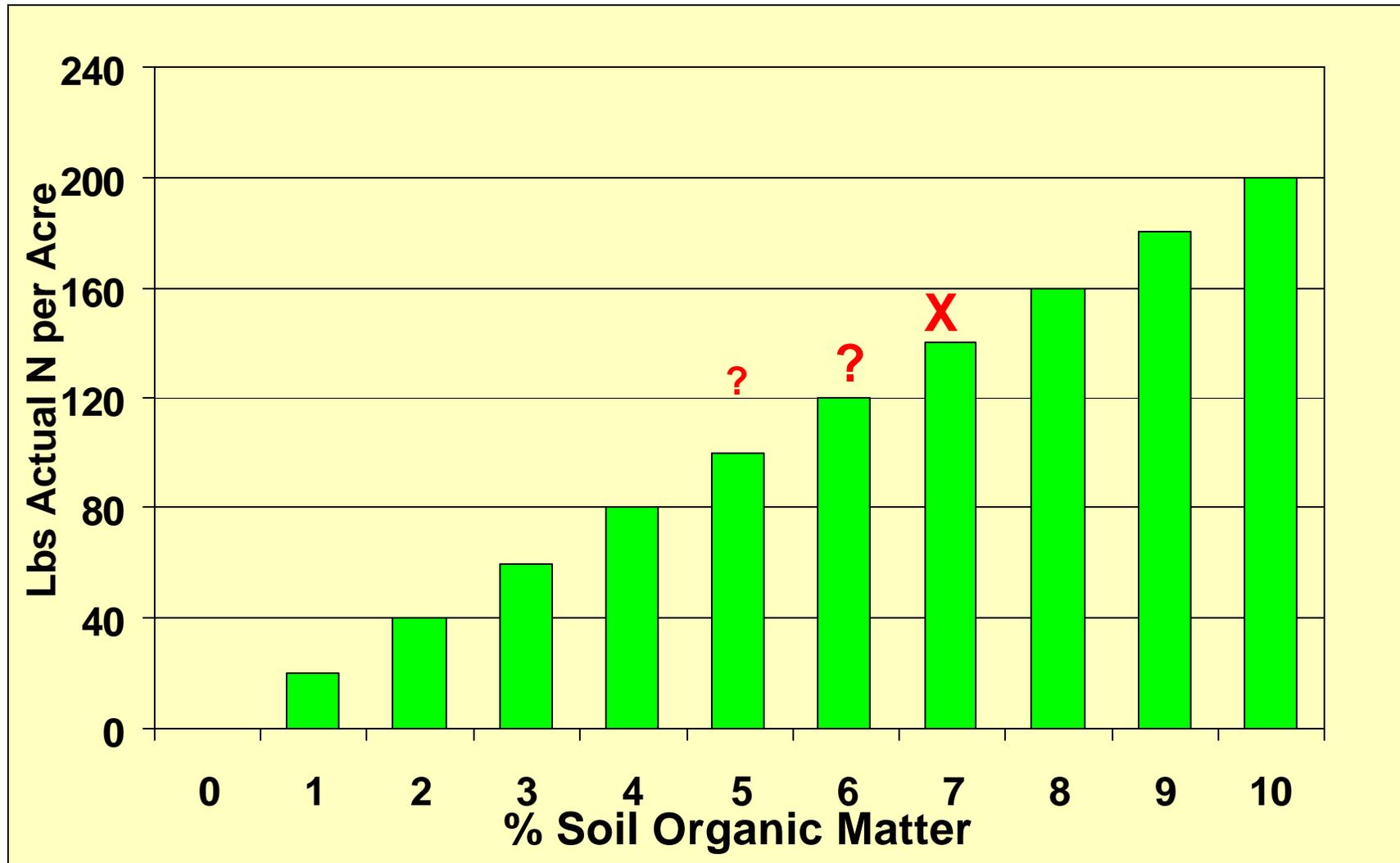
Soil Organic Matter

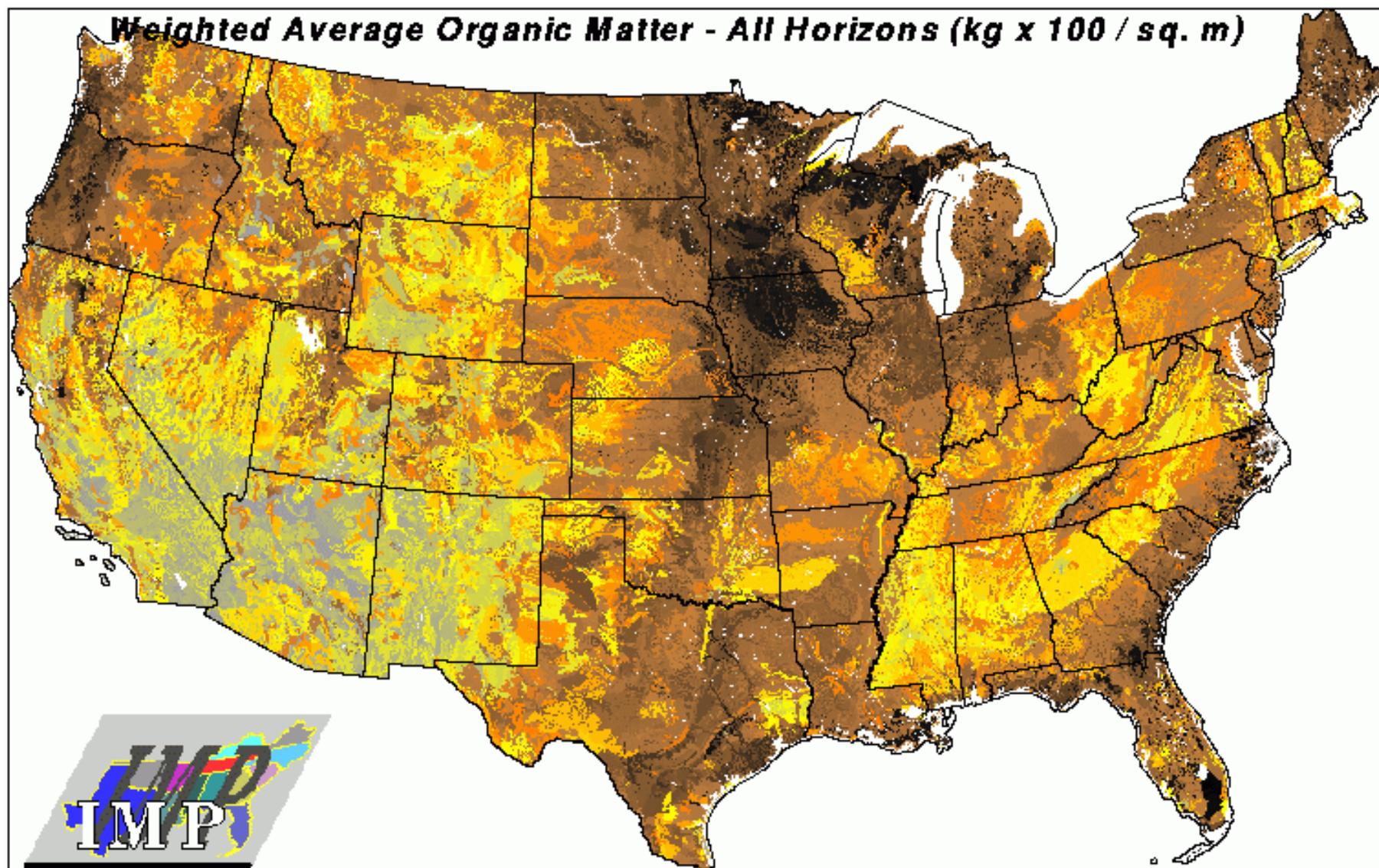
- Improves soil structure, moisture retention and fertility.
 - 2 to 3% is considered ideal for grapes.
- Midwest Soils:
 - Range from < 1% up to 20%
 - Well-drained soils in the 3 to 4% range
 - OM is higher in poorer drained soils.
- Vermont soils vary:
 - Higher in the Champlain Valley.
 - Low in the river valleys.
- Grapes grown on high organic soils tend to be less winter hardy.

Release of N from organic matter.

20 lb N / % OM / Ac / Yr

Nitrogen Released from Organic Matter





<http://www.geobabble.org/~hnw/esri98/P33310.GIF>

Vermont Soils

Champlain Valley

- Silty to clayey soils.
- Most are naturally acid & liming has been done.
 - Band of calcareous soils near the lake w/ a naturally high pH.
- High CEC.
- High in K.
- Some relatively high Mg.
- Low in P
- B can be low

River Valleys

- Sandy to loamy soils
- They are naturally acid & liming has been done.
- Low CEC.
- Low in Mg.
- High in P.
 - Naturally high
 - From manure
- B can be low

Pre-plant Soil Test

- Test for: **pH, P, K, Mg, Zn, O.M. (B)**
- Separate sample for each soil type.
- Separate samples for different cropping histories.
- Submit samples collected from 2 depths:
 - **0 to 6 inch, or 0 to 8 inch** depth.
 - **6 to 12 inch, or 8 or 16 inch** depth.
- Have your Extension specialist look over the results.

Cost of Establishing a Vineyard



Iowa State University

Dept. of Horticulture

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... and justice for all.

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Winery and Vineyard Feasibility Workbooks

Created September 2005

The Cost to Establish a Vineyard workbook is designed to report all the income and expense of a one-acre vineyard for up to 13 years. There are three different vineyard workbooks, each for a different trellis style.

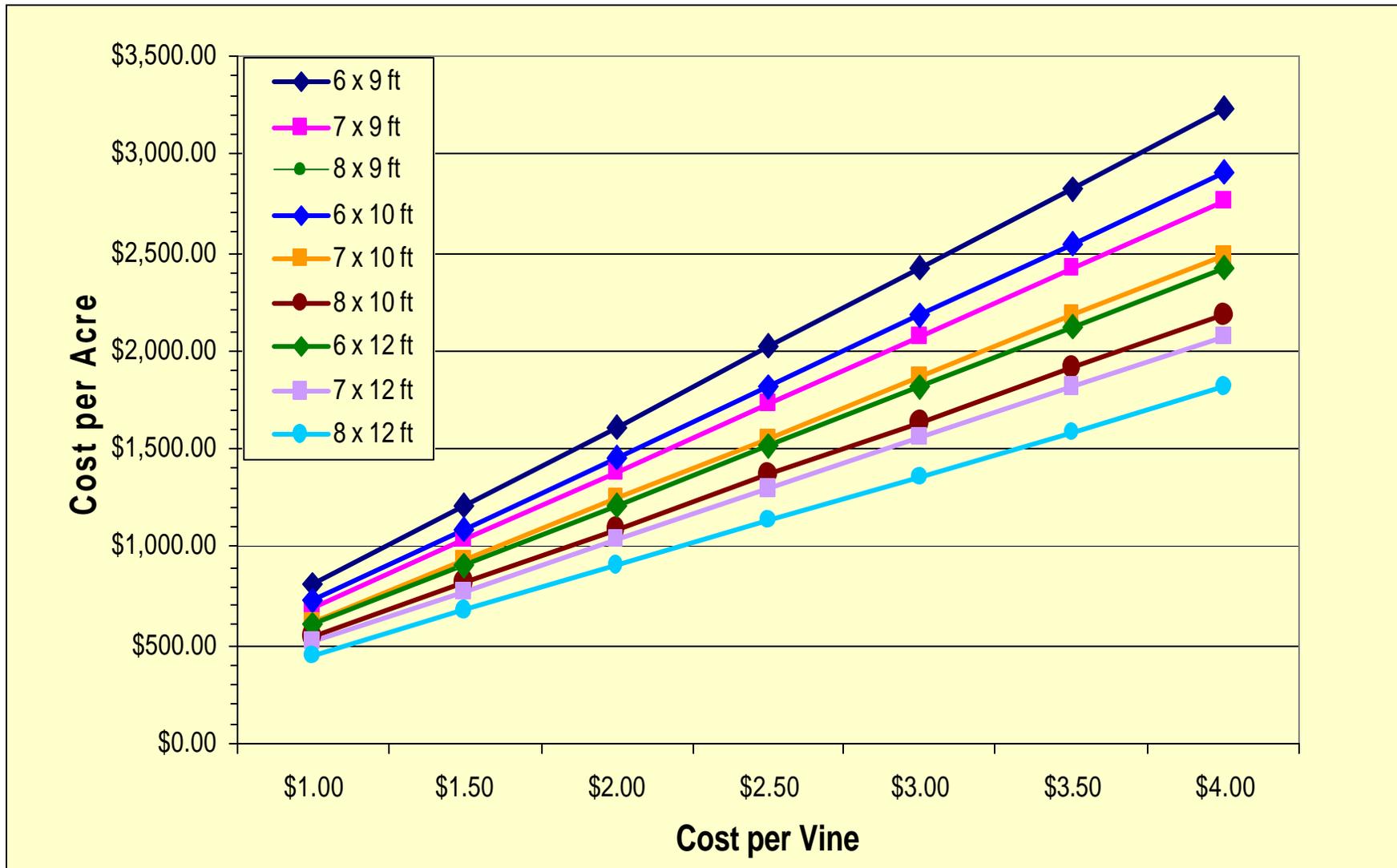
- High Trellis
- Geneva Double Curtain
- Vertical Shoot Position

- [Winery Ten Year Financial Planning Workbook \(version 5\)](#)
 - Errors in the asset worksheet of version 1 were found in Column J that may affect the total investment. If you are using version 1 please check the numbers in cell J35, J49, and J185. Also check to see if the numbers add up correctly on line 181.
- [Estimated Vineyard Establishment with a High Trellis and Production Cost Per Acre](#)
- [Estimated Vineyard Establishment with a Geneva double Curtain and Production Cost Per Acre](#)
- [Estimated Vineyard Establishment with a Vertical Shoot Position and Production Cost Per Acre](#)

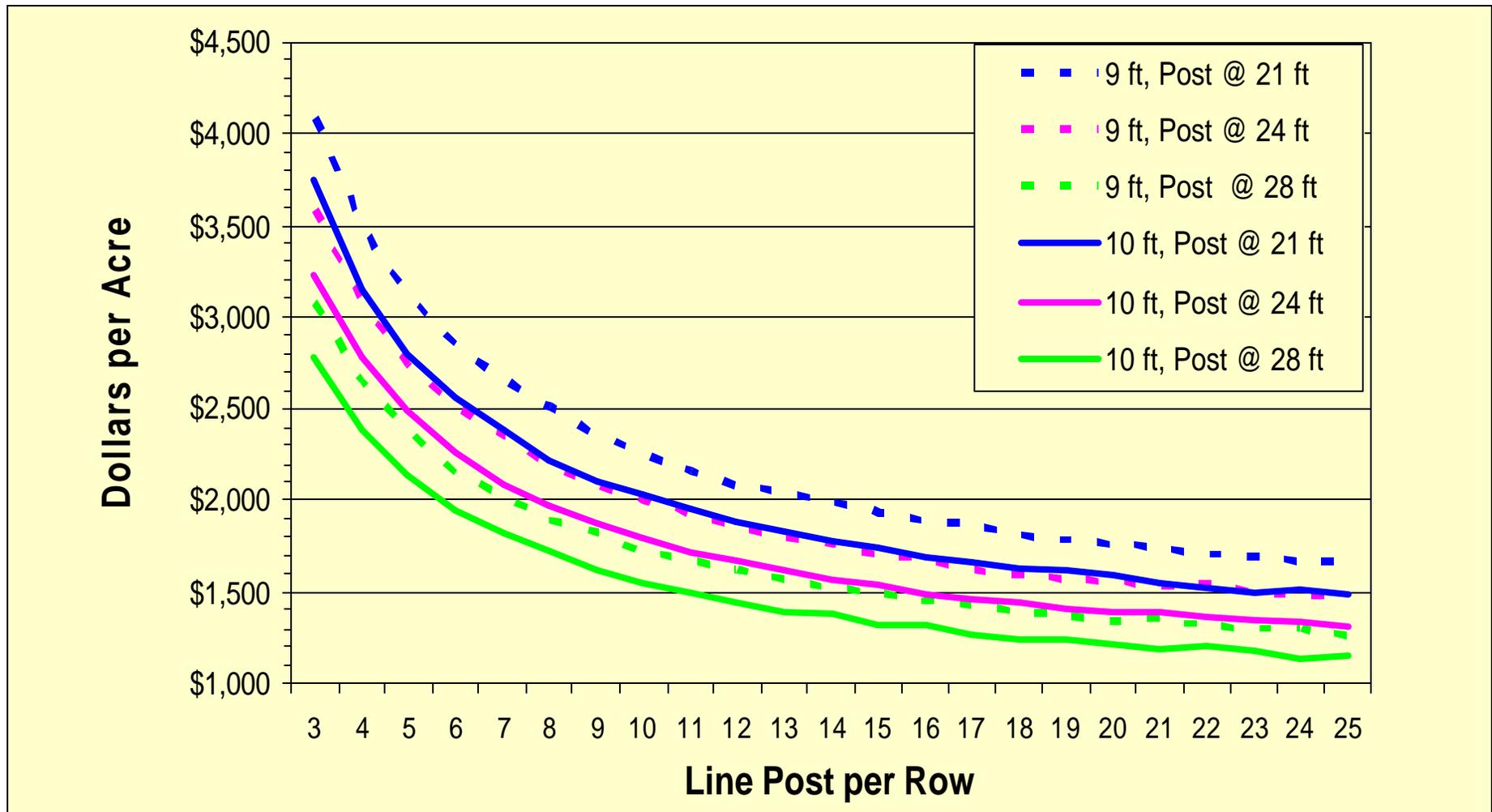
Factors Affecting the Cost of Vineyard Establishment

- Vine spacing (number per acre)
- Cost of the vines
- Method of planting
 - By hand, w/ an auger, or planting machine
- Length of the rows
- Line post spacing (post per acre)
- Method used to install the line post
 - Post driver, or post hole auger
- End post design (Anchored vs H-Brace)
- Number of wires per row (training system)

Vine Cost per Acre



Cost of Trellis Materials per Acre



Trellis Systems

**Single Curtain Bi-lateral Cordon
(Hi-Trellis)**



2 wires

**Catch Wire System
(VSP)**



7 wires

6-cane Kniffen



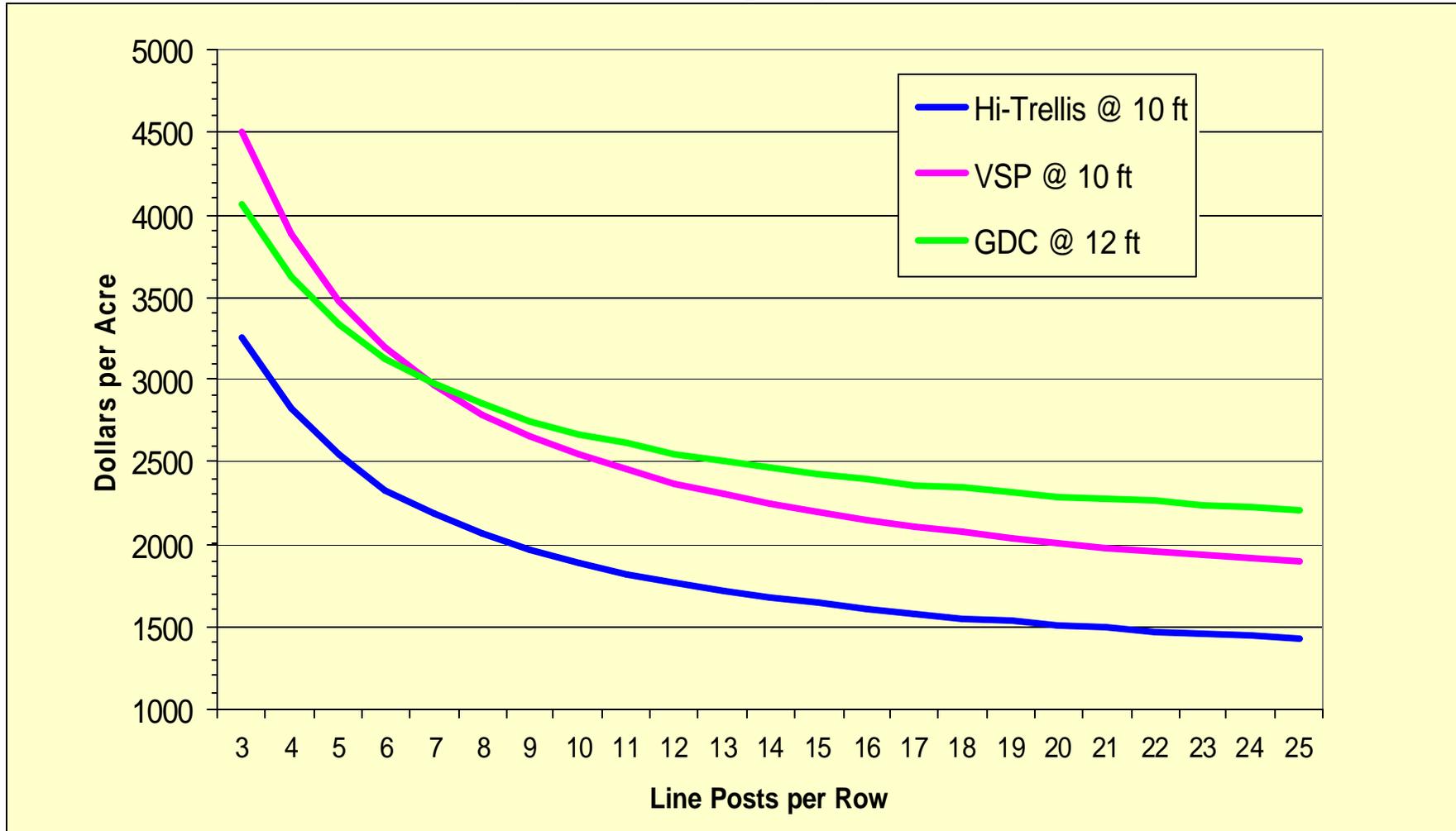
3 wires

Geneva Double Curtain



3 - 4 wires

Cost of Trellis Material by Training System*



* With H-brace end post system

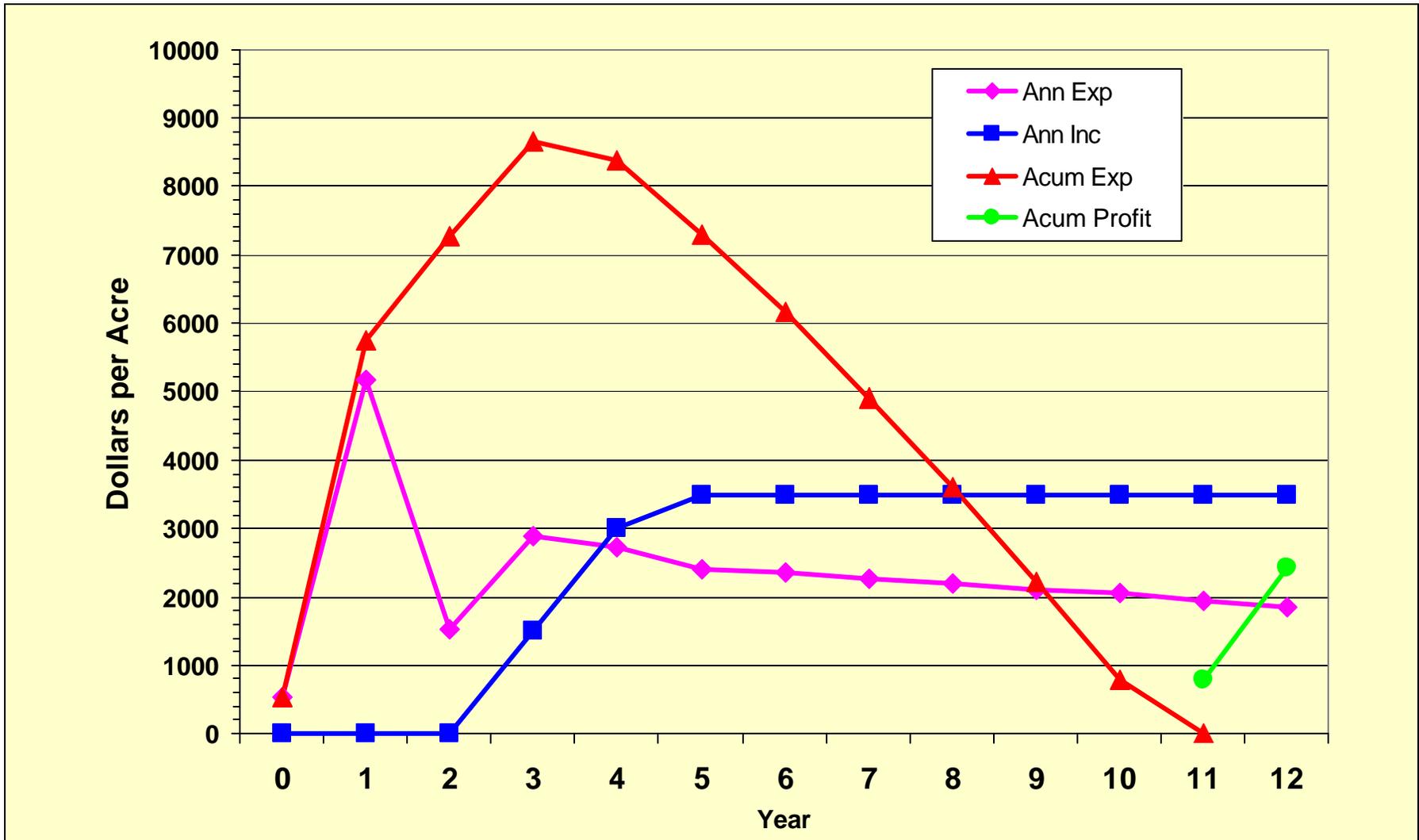
Vineyard Establishment Workbooks

Assumptions

- Vines @ \$ 1.75 (Maréchal Foch)
- 8 x 10 ft spacing (545 vines/A)
- Trained to a hi-trellis (single curtain cordon)
- Plant by machine
- H-Brace w/ short end post
- Labor @ \$8.69 (\$8.00/hr + FICA)
- Financed @ 6% interest
- Production @ \$1,000 per ton
 - Year 3 1.5 tons
 - Year 4 3.0 tons
 - Year 5 + 3.5 tons

Hi-Trellis Establishment Budget

Maréchal Foch

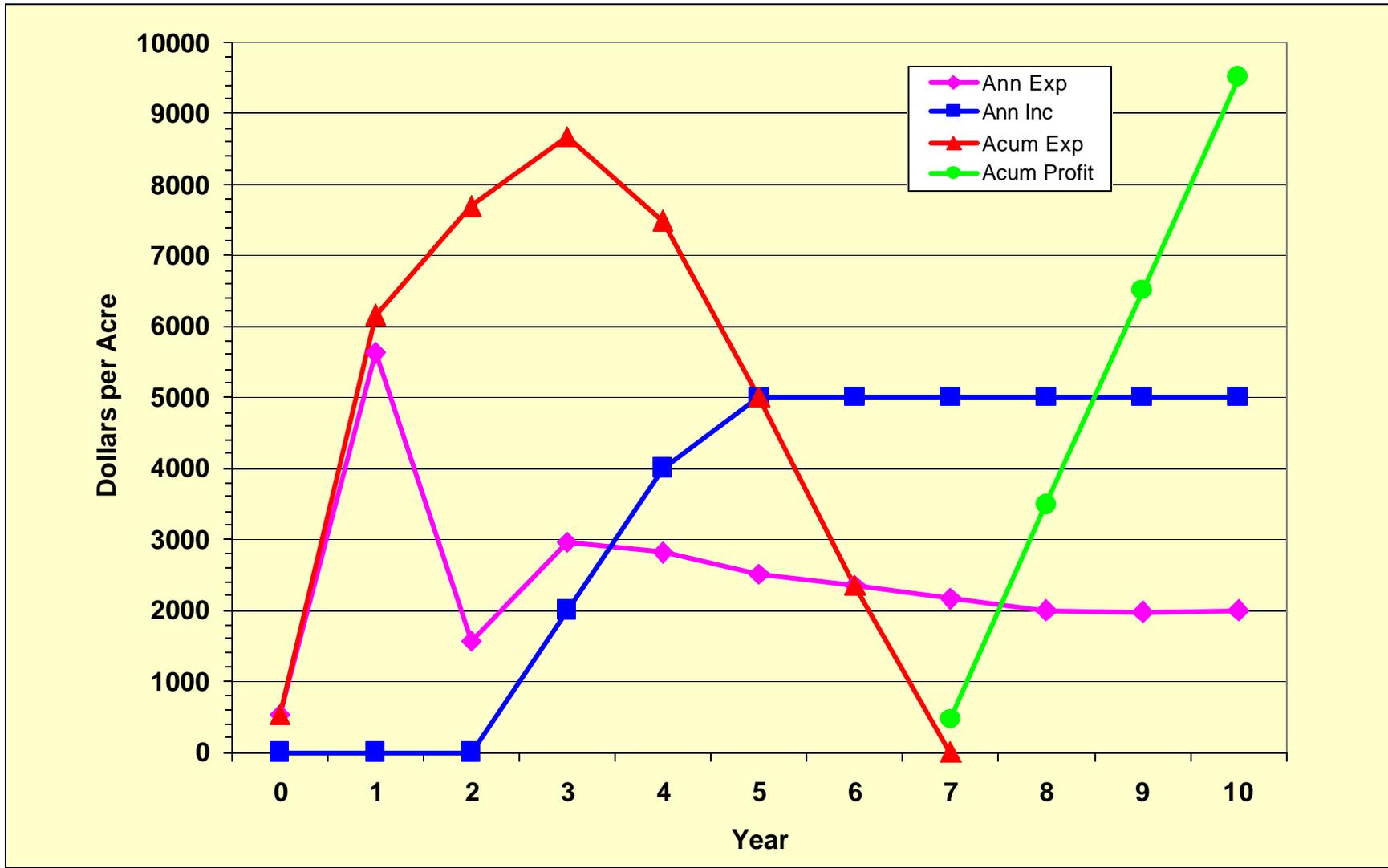


Vineyard Establishment Workbooks

Assumptions

- Vines @ \$ 2.50 (Frontenac)
- 8 x 10 ft spacing (545 vines/A)
- Trained to a hi-trellis (single curtain cordon)
- Plant by machine
- H-Brace w/ short end post
- Labor @ \$8.69 (\$8.00/hr + FICA)
- Financed @ 6% interest
- Production @ \$1,000 per ton
 - Year 3 2.0 tons
 - Year 4 4.0 tons
 - Year 5 + 5.0 tons

Hi-Trellis Establishment Budget Frontenac





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