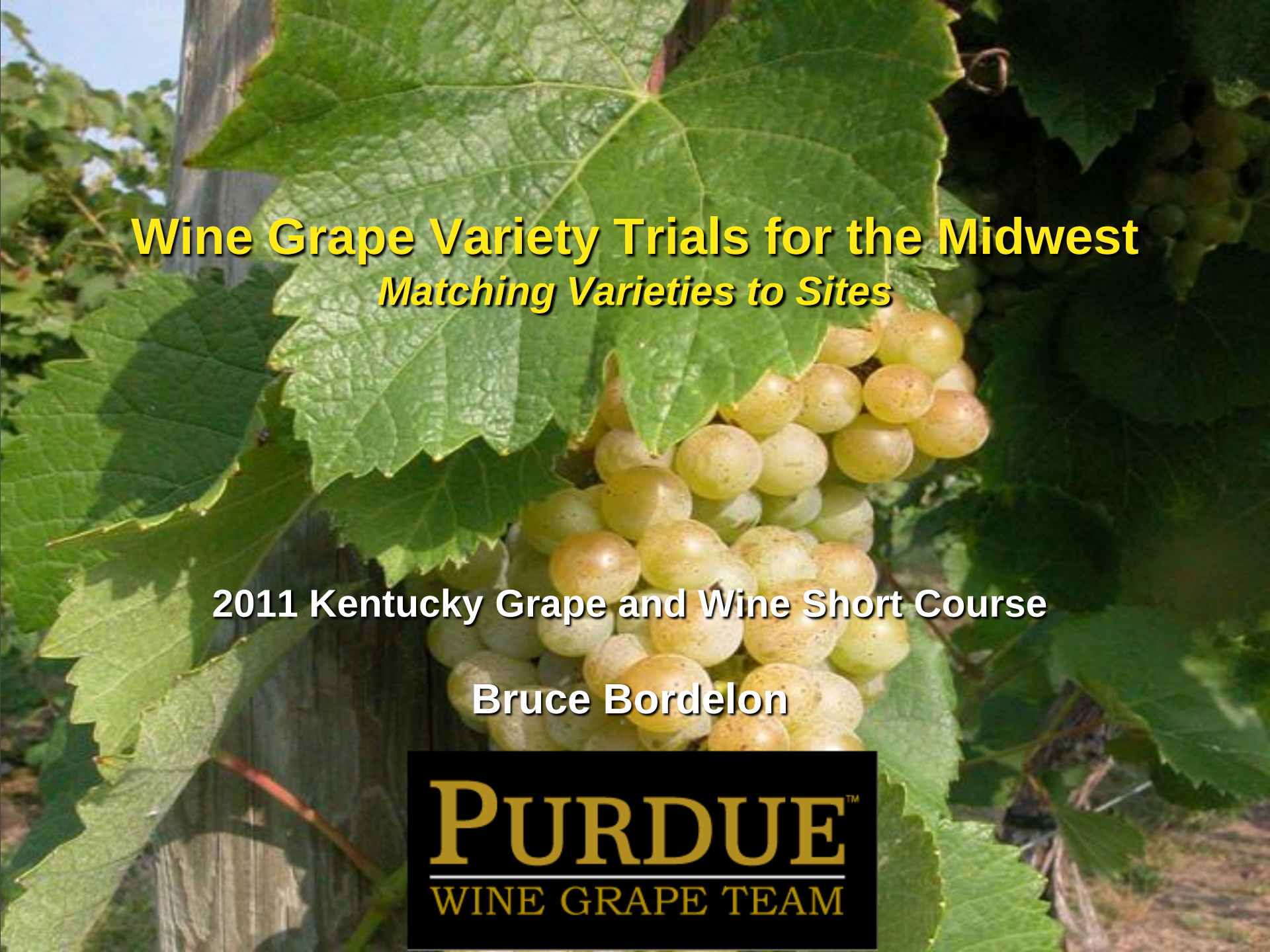

Wine Grape Variety Trials for the Midwest

Matching Varieties to Sites

2011 Kentucky Grape and Wine Short Course

Bruce Bordelon

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Why test varieties?

- Service to the industry
  - Identify varieties well adapted to our region that make good wine = Sustainable production
  - Determine strengths and weaknesses to advise growers
- Service to U.S. breeding programs
  - Determine if selections are worthy of release
  - Performance of selections in new climates
- New NE-1020 Multistate trials
  - Compare performance across wide range of climates

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Strengths and Weaknesses

- Cold hardiness
- Disease susceptibility
- Fruit/wine quality
  - Date or ripening, fruit chemistry
- Vigor/yield relationship
- Etc.

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Strengths

- Cold hardiness
  - Frontenac, Marquette, LaCrescent
- Disease susceptibility
  - Norton, Steuben, Cayuga white
- Fruit/wine quality
  - Traminette, Valvin muscat, Chambourcin
- Vigor/yield relationship
  - Noiret, Vidal, Cayuga white

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Weaknesses

- Cold hardiness
  - vinifera, Chambourcin, Cayuga white
- Disease susceptibility
  - Traminette, Vignoles, vinifera
- Fruit/wine quality
  - Norton, vinifera, Frontenac
- Vigor/yield relationship
  - Norton, Traminette, Valvin muscat

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Recent Releases

- New York
  - NY 70.809.10 = Corot noir
  - NY 73.136.17 = Noiret
  - NY 62.122.1 = Valvin muscat
  - NY 65.533.13 = Traminette
- Minnesota
  - MN-1047 = Frontenac
  - MN-1166 = LaCrescent
  - MN-1211 = Marquette

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Publications

Grape Varieties for Indiana (HO-221)

Midwest Grape Production Guide (OSU Bulletin 919)

Growing Grapes in Kentucky (ID-126)

Bruce Bordelon
Purdue Horticulture and Landscape Architecture
www.hort.purdue.edu
All photos by Bruce Bordelon and Steve Somermeyer

Selecting an appropriate grape variety is a major factor for successful production in Indiana and all parts of the Midwest. There are literally thousands of grape varieties available. Realistically, however, there are only a few dozen that are grown to any extent worldwide, and fewer than 20 make up the bulk of world production. Consistent production of high quality grapes requires properly matching the variety to the climate of the vineyard site.

This publication identifies these climactic factors, and then examines wine grape varieties and table grape varieties. Tables 1, 2, and 3 provide the varieties best adapted for Indiana, their relative cold hardiness and disease susceptibility, and their yield performance at two test locations in the state.

Weather and Variety Selection

The major climatic factors affecting Indiana grape production are:

- Winter cold and spring frosts
- Length of the growing season and heat unit accumulation
- Rainfall during the ripening period

Matching the variety's characteristics to the site climate is critical for successful grape production. Varieties differ significantly in their cold hardiness, ripening dates, tolerance to diseases, and so on, so some are better suited to certain sites than others.

The most important considerations in variety selection are:

- Matching the variety's cold hardiness to the site's expected minimum winter temperatures
- Matching the variety's ripening season with the site's length of growing season and heat unit accumulation

The minimum temperature expected for an area often dictates variety selection. In Indiana, midwinter minimum temperatures range from 0 to -5°F in the southwest corner, to -15 to -20°F in the northwest and north central regions. Very hardy varieties can withstand temperatures as cold as -15°F with little injury, while tender varieties will suffer significant injury at temperatures slightly below zero.

Remember, cold hardiness is a genetically controlled trait and the full expression of that trait can be adversely affected by stresses such as over cropping, drought, and disease. Furthermore, the timing of the cold event relative to the vine acclimation and the rate and amount of temperature change can dramatically affect the amount of cold injury sustained.

The length of the growing season is determined by the dates of first and last frosts of the year. Often referred to as frost-free days, this period lasts 190 to 200 days in the south and 150 to 160 in the north. In general, early

Table 2. *Grape Variety Performance in Southwest Indiana*[1]

Variety	Average Harvest Date	Yield[2] (lbs/vine)	Cluster Weight[3] (g)	Berry Weight[4] (g)	Brix[5]	pH[5]	TA[5] (g/L mal)	Pruning Weight[6] (lb/vine)	Crop Load[7] (yld/pw)
Cayuga White	8/27	27.2	206.5	2.9	17.7	3.22	7.7	1.0	27.2
Chambourcin	9/14	18.8	189.9	2.4	20.7	3.28	9.1	1.1	17.1
Chardonel	8/27	14.3	173.6	2.1	21.0	3.15	10.6	0.9	15.9
Concord	9/8	23.0	143.4	3.6	16.4	3.51	5.1	4.0	5.8
Cofot noir	9/3	18.3	225.2	2.6	17.7	3.28	10.0	2.0	9.2
Foch	8/20	23.5	95.5	1.2	19.9	3.42	9.4	2.2	10.7
Frontenac	8/19	12.2	128.6	1.2	22.3	3.38	12.6	1.2	10.2
Frontenac gris	8/23	8.5	96.4	1.1	25.3	3.51	10.6	0.6	14.2
Jupiter	8/22	12.7	161.9	4.2	20.5	3.62	4.0	0.6	21.2
La Crescent	8/19	8.6	82.4	1.3	24.1	3.43	12.2	1.6	5.4
La Crosse	8/21	20.9	115.9	1.7	17.9	3.25	9.2	2.4	8.7
Marquis	8/30	17.6	225.4	4.0	17.5	3.42	5.8	2.0	8.8
Neptune	8/29	13.8	297.0	3.9	18.3	3.31	7.9	0.9	15.3
Noiret	9/9	20.0	209.6	2.1	17.6	3.27	7.2	3.7	5.4
Norton (Cynthiana)	9/18	17.2	91.5	1.1	21.2	3.38	8.8	3.2	5.4
Seyval	8/24	22.0	204.5	1.9	19.5	3.24	7.6	0.9	24.4
Steuben	9/1	26.2	251.8	3.4	18.5	3.40	4.5	1.7	15.4
Suffolk Red	8/27	11.0	156.9	3.0	21.0	3.32	5.5	1.1	10.0
Sunbelt	8/31	10.4	119.2	4.5	17.9	3.43	5.8	1.5	6.9
Traminette	9/2	16.5	144.8	1.8	18.9	3.21	7.1	3.1	5.3
Valvin Muscat	8/25	17.5	101.8	2.5	15.9	3.39	8.1	1.9	9.2
Vidal	9/4	20.4	195.9	1.9	19.9	3.13	7.5	1.2	17.0
Vignoles	8/23	15.0	110.9	1.5	21.4	3.16	2.7	1.9	7.9

[1]Data averaged over 14 years (1995–2008) for most varieties. Trials performed at the Southwest Purdue Agriculture Center, Vincennes, Indiana.
[2]Yield in pounds per vine can be converted to pounds per acre. At standard 8 x 10 spacing, there are 545 vines per acre. So a variety that with a yield of 10 pounds per vine would yield 2.7 tons per acre.
[3]1 pound=454 grams. Clusters that weigh about 150 grams are approximately 1/3 pound.
[4]Berry weights are relative to variety type. Wine grape varieties are selected for small berries to increase skin to pulp ratio. Table and juice grapes tend to have much larger berries.
[5]Juice chemistry parameters: Brix=percent sugar content; pH=juice pH (strength of acid); TA=juice titratable acidity (amount of acid). These parameters are important in wine making, and perception of flavor.
[6]Pruning weight. This is provided as pounds of 1-year-old canes pruned. The appropriate range is 1-3 pounds. A pruning weight less than 1 pound indicates low vigor and weak growth, or considerable fall dieback of canes. Pruning weights greater than 3 pounds indicate very high vigor.
[7]Crop Load is the ratio of yield (yld) to pruning weight (pw), which is a measure of vine balance. The appropriate range is 8-12. Higher ratios indicate that too much fruit was retained per vine (often due to large cluster size), of low pruning weight because of fall dieback of canes. Low ratios indicate low fruitfulness relative to vegetative vigor. It is important to note that these yield figures have been adjusted through pruning and cluster thinning. Many varieties would over crop if improperly pruned or cluster thinning was not performed. Growers should use these data as a general guideline only.

Variety Adaptation to Climate

- **Temperature**
  - Minimum winter temperature
    - Cold hardiness
  - Heat accumulation and season length
    - Date of bud break and ripening
- **Rainfall**
  - Amount and distribution, especially from veraison to harvest
    - Ripening date and tendency toward rot problems

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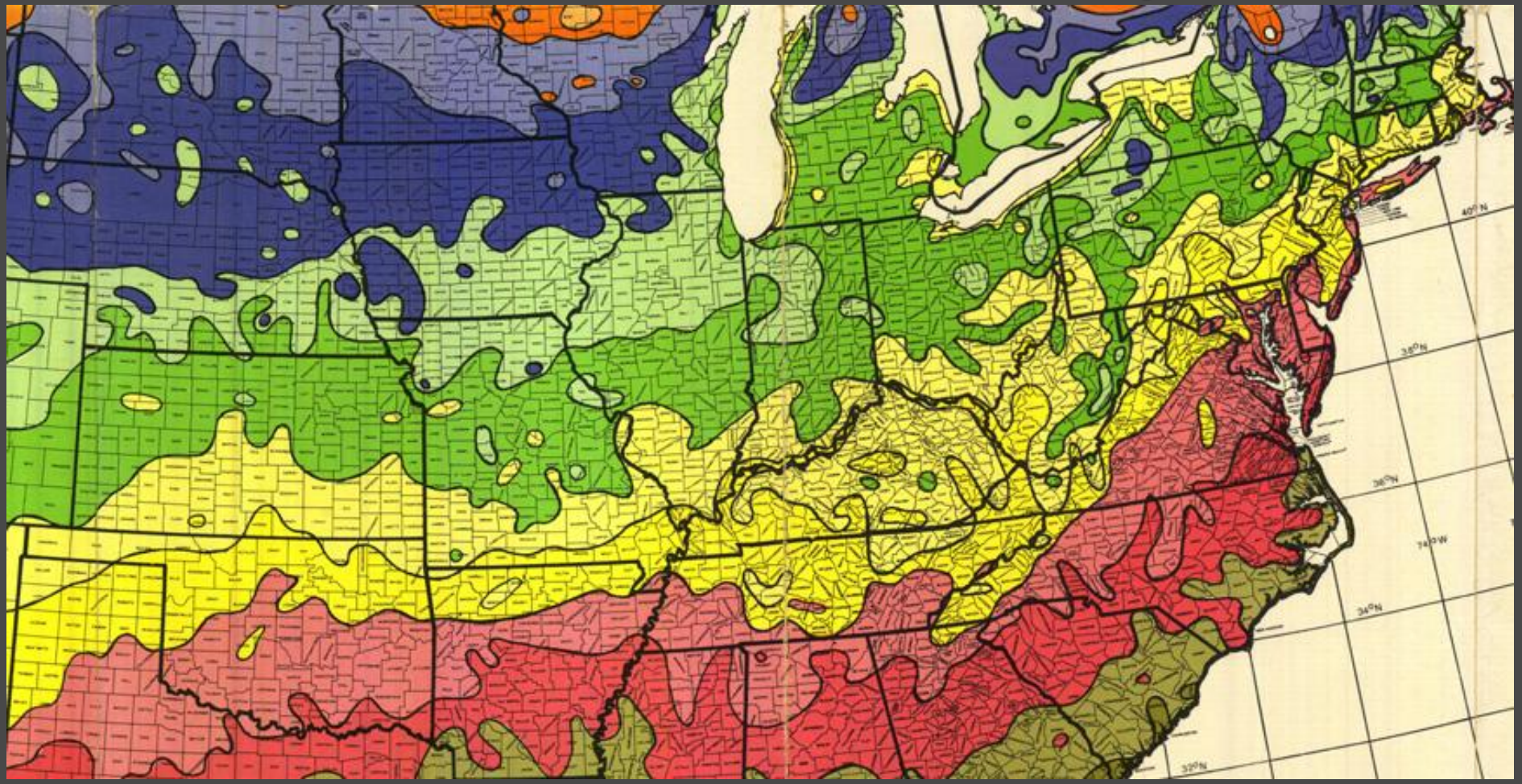
Midwest Climate

USDA Plant Hardiness Zone Map



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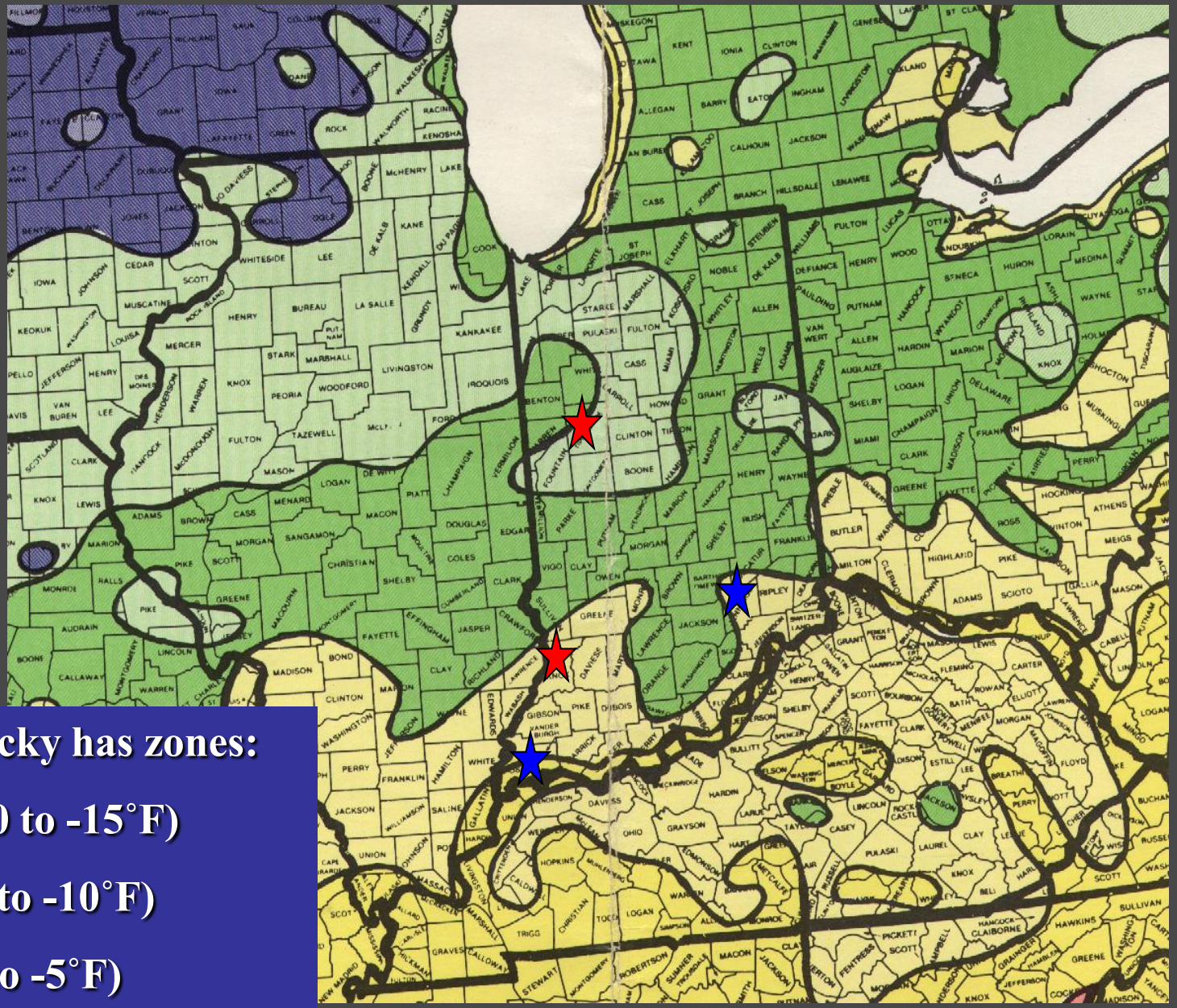

Kentucky has zones:

5b (-10 to -15˚F)

6a (-5 to -10˚F)

6b (0 to -5˚F)

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General Guidelines to Match Variety Hardiness to Site

- Excellent sites 6b (0 to -5˚F)
  - all commercial varieties including vinifera
- Good sites 6a (-5 to -10˚F)
  - most commercial varieties (except vinifera)
- Acceptable sites 5b (-10 to -15˚F)
  - moderately hardy varieties (hybrids, labrusca)

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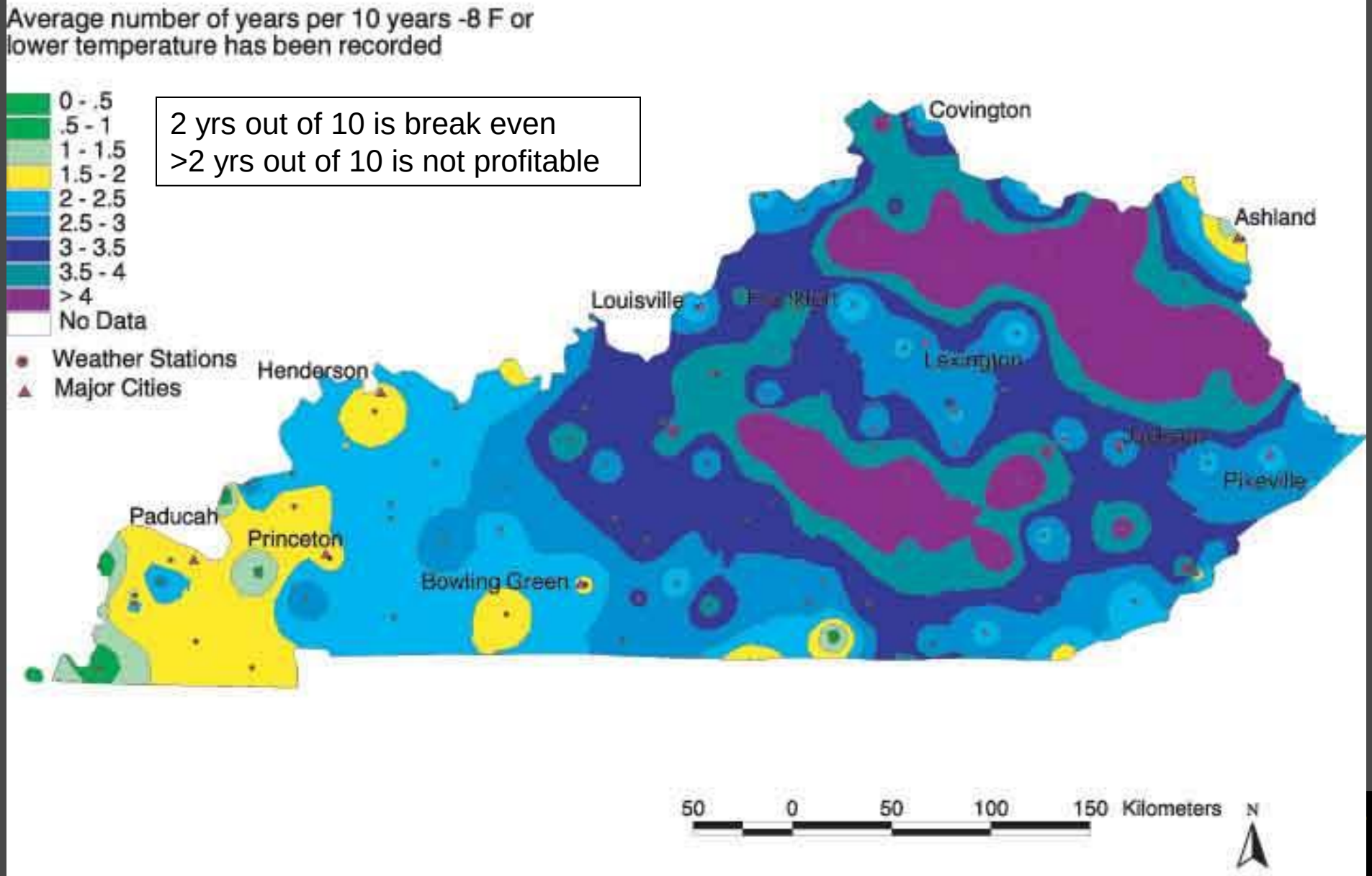
Freeze Danger for Vinifera Grapes in Kentucky

-8 degree F. threshhold



Cold Damage to Buds

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Cold damage to vine trunks
Crown Gall

Crown Gall

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Disease-free Nursery Stock?

Date of bud break - Frost damage

- Cultivar's potential to be damaged by frost is directly related to it's date of bud break.
  - Early (e.g. Foch, Marquette. GR-7) much more likely to be damaged than late (e.g. Chambourcin, Vidal)
- Choose cultivars accordingly
- Plant late budding cultivars on most frost prone sites (elevation, slope, aspect, etc)

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Frost Damage

Relative Date of Bud Break

(About 2 week range)

- **Early**
  - **Foch, St. Croix, Marquette, LaCrescent, GR-7, DeChaunac**
- **Mid**
  - **Seyval, Chardonel, Frontenac, LaCrosse, Corot noir, Noiret, Norton, etc.**
- **Late**
  - **Chambourcin, Steuben, Traminette, Vidal, Vignoles**

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Temperature During Ripening

Fruit quality is best if fruit ripens under warm days and cool nights

- **Match ripening date to climate**
  - **Don't grow early ripening grapes in a long season, hot area (excess heat) ****
  - **Don't grow late ripening grapes in a short season, cool area (insufficient heat)**

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Theories on Heat Affects

- Amerine & Winkler, 1944. California Zones I-V based on GDDs base 50˚F (I<2500…..V>4000)
- Coombe, 1987. Temps >86˚F day & >64˚F night are detrimental to fruit quality. Optimal temperature is 68-77˚F day, 59-68˚F night
- Gladstones, 1992. Mean temp of 64-70˚F during final month of ripening. Biologically Effective days
- Butler, 2004. Quality ripening days (GDD base 50 <22) veraison to harvest (Ave daily temp <72)
- Happ, 2004. Daily heat load (>22˚C) during last 28 days

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Rainfall During Ripening

- Rainfall between veraison and harvest almost always leads to a reduction in fruit quality
  - Occurrence of bunch/fruit rots
    - Vignoles, Seyval, etc are very prone to bunch rots
  - Dilution of sugar, acid, flavors

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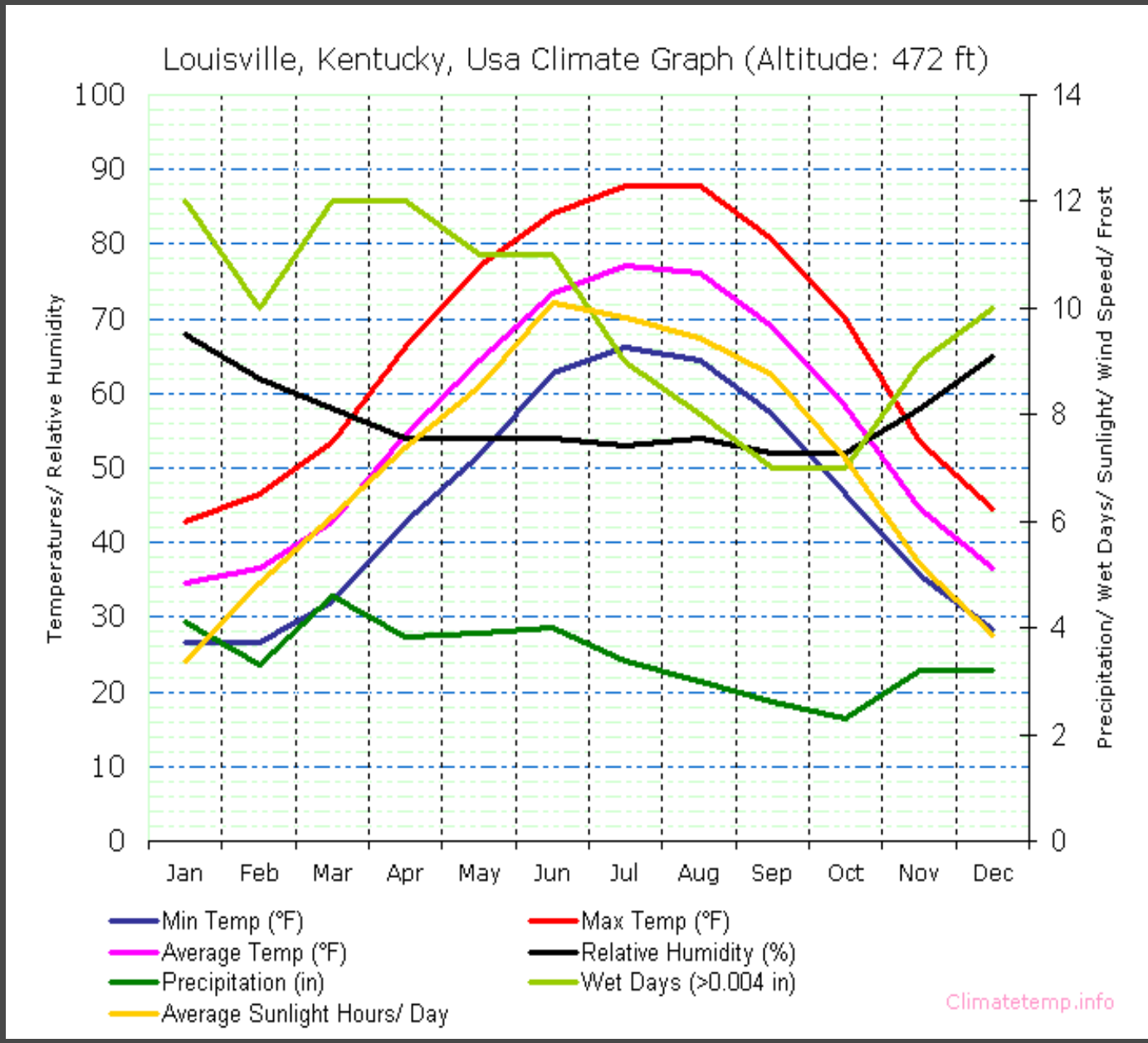
Optimum conditions
Temperature 68-77 day
59-68 night
Mthly Ave 64-70
Daily Ave <72
Minimal rainfall.

Sept is the best month for varieties to ripen in the Louisville area



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Summary of Matching Varieties to Climate

- Choose varieties that:
  - have adequate cold hardiness
  - ripen during the appropriate time
  - can tolerate some rainfall during ripening

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Viticultural Regions of Kentucky

Table 1. Macroclimatic regions for viticulture in Kentucky based on climate data, 1974-2005.

Feature	Region I	Region II	Region III	Region IV	Region V
Occurrence of -15°F: percent of time	Hardly at all	Rarely	Frequently	Very frequently	Extremely frequently
Winter severity index: January mean temperature	Mildly cold (23°F to 32°F)	Cold (14°F to 23°F)	Very cold (5°F to 14°F)	Extremely cold (<5°F)	Extremely cold (<5°F)
Spring frost index (SPI): difference between average mean and average minimum for April	Very low risk	Low risk	Moderate risk	Moderate risk	High risk
Growing degree days: 50°F base temperature from 1 April through 30 October	3000-4000	3000-4000	3500-4000	3500-4000	>4000
Frost free days: between last spring frost occurrence at 32°F and first fall frost occurrence at 32°F	>181	>181	171-180	160-170	160-170
Growing season mean temperature: mean of daily maximum temperatures between 1 April and 30 October	Coolest	Cool	Intermediate	Warm	Hot

Source: UK HO-87

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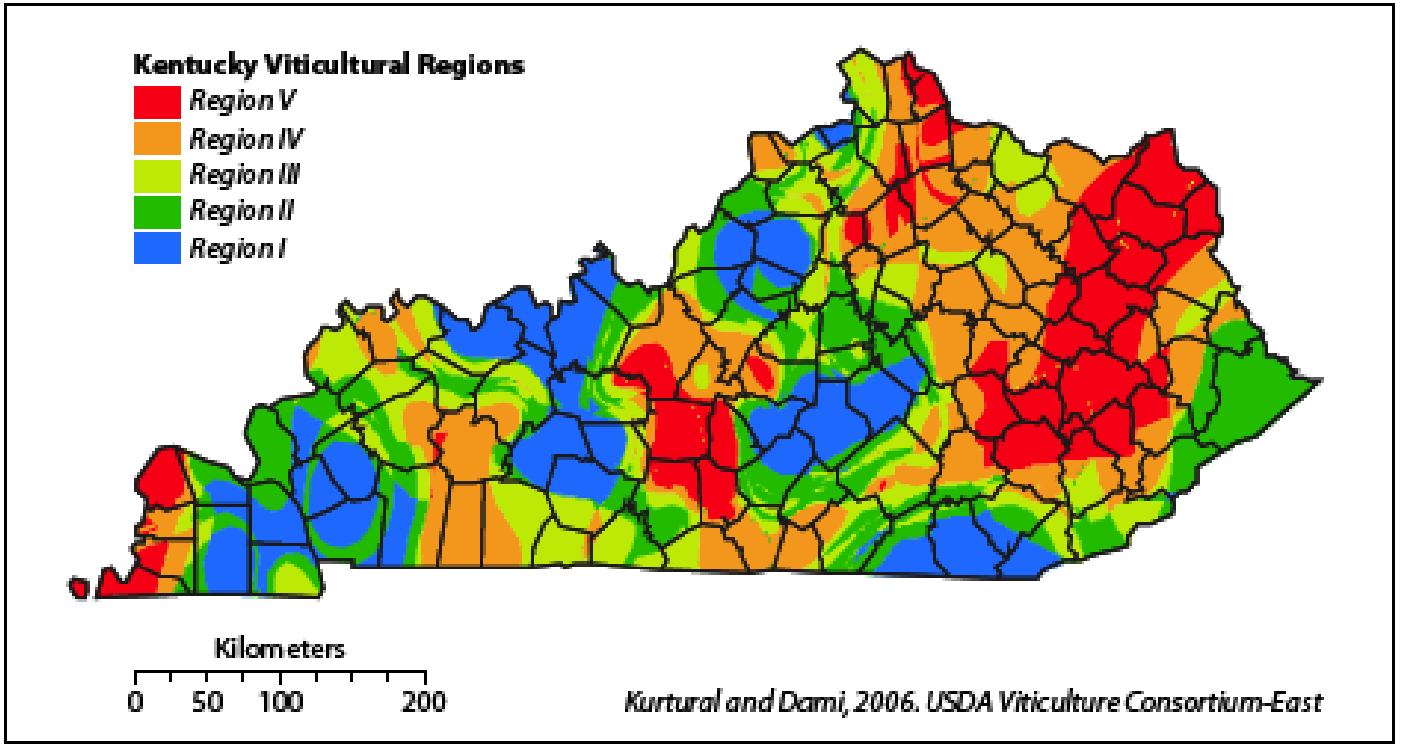
Viticultural Regions of Kentucky

Figure 1. Viticultural regions of Kentucky.



Source: UK HO-87

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Suggested Varieties for Kentucky

Table 4. Summary of commercial grapes cultivars suitable for planting in Kentucky based on macroclimatic regions.

Cultivar	Region I	Region II	Region III	Region IV	Region V
Vinifera	None	None	None	None	None
Hybrid reds	Chambourcin Chancellor Corot Noir Noiret	Chancellor Corot Noir GR-7M Noiret St. Croix St. Vincent	Chancellor DeChaunac GR-7M Frontenac Leon Millot Marechal Foch Marquette St. Croix St. Vincent	DeChaunac GR-7M Frontenac Leon Millot Marechal Foch Marquette St. Croix St. Vincent	Frontenac Leon Millot Marechal Foch Marquette St. Croix St. Vincent
Hybrid whites	Cayuga white Chardonel Seyval blanc Traminette Valvin Muscat Vidal blanc Vignoles	Cayuga white Frontenac gris Seyval blanc Valvin Muscat Vidal blanc Vignoles	Frontenac gris LaCrescent LaCrosse Seyval blanc Vignoles	Frontenac gris LaCrescent LaCrosse Seyval blanc	Edelweiss Frontenac gris LaCrescent LaCrosse
American reds	Alden Catawba Delaware Norton	Alden Catawba Delaware Fredonia Norton	Alden Catawba Delaware Fredonia	Alden Catawba Delaware Fredonia Steuben	Alden Catawba Delaware Fredonia Steuben
American whites	Niagara	Niagara	Niagara	Niagara	Niagara

Source: UK HO-88

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Wine Grape Acreage in Kentucky, 2008

Variety	Acreage	Rank
Vidal	53	1
Cabernet Sauvignon	47	2
Chambourcin	47	3
Norton	43	4
Cabernet Franc	36	5
Traminette	31	6
Chardonnay	21	7
Riesling	19	8
Chardonel	15	9
Seyval	12	10
Syrah	11	11
Cayuga White	11	12
Foch	10	13
Vignoles	9	14

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Kentucky Grape Trends

- Late ripening hybrids make most sense
  - Vidal, Chambourcin, Norton, Traminette
- About 50% vinifera is risky
- Little “new” varieties
  - Noiret, Valvin muscat, Marquette etc.
- Suggest grower coordinated trials
  - Share experiences with new varieties

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Summary

- Match best varieties to best sites
- Strive for premium quality
  - From all varieties….

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