



**What can we grow in Indiana?**  
*Indiana climate vs. varieties*

**2007 Indiana Wine Grape Symposium**

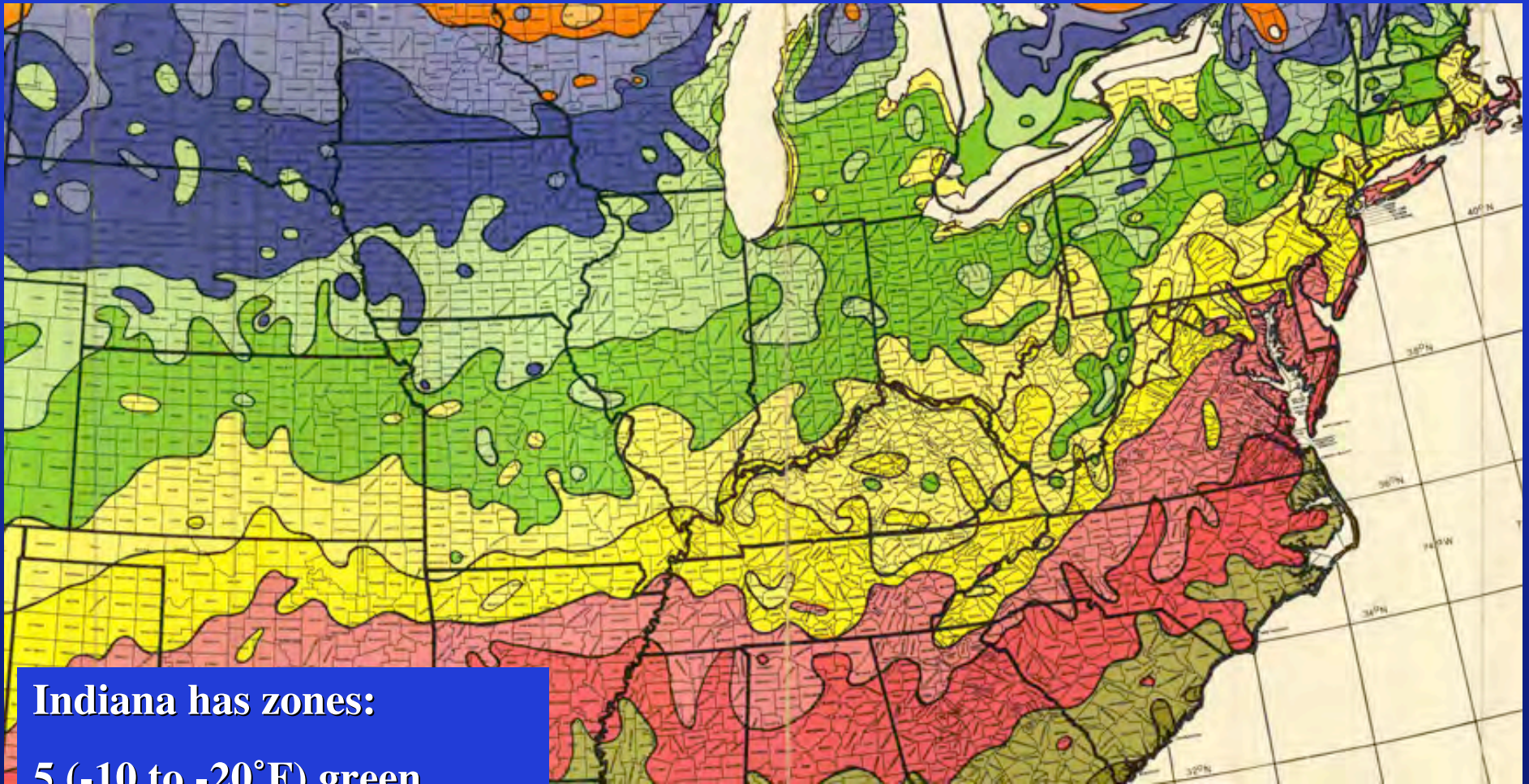
**Bruce Bordelon  
Purdue Viticulture**

# 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

# Indiana Climate

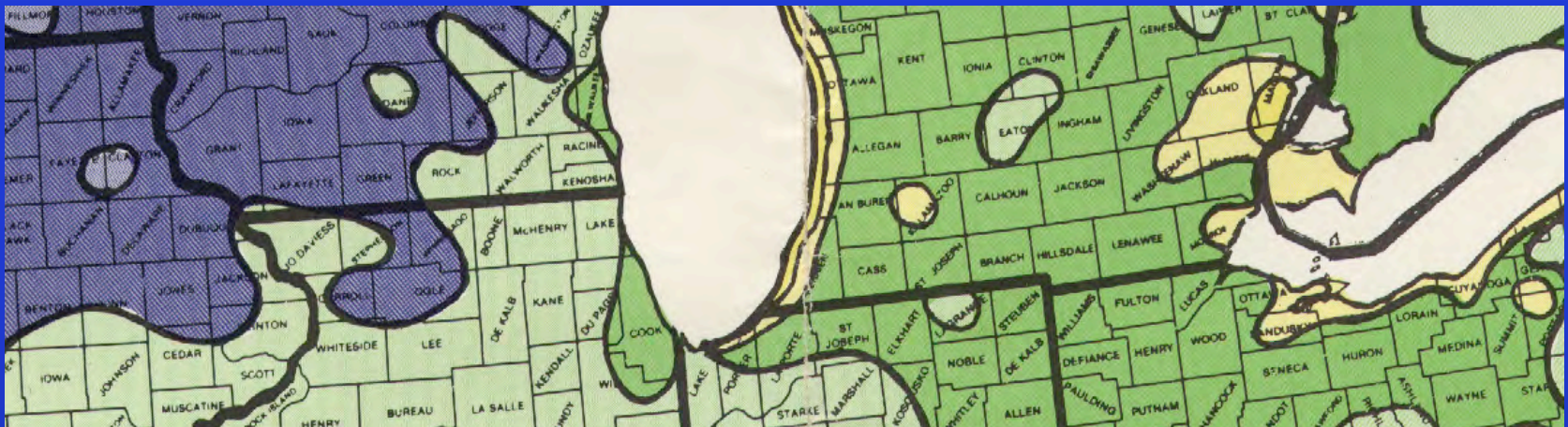
## USDA Plant Hardiness Zone Map



Indiana has zones:

5 (-10 to -20°F) green

6 (0 to -10°F) yellow



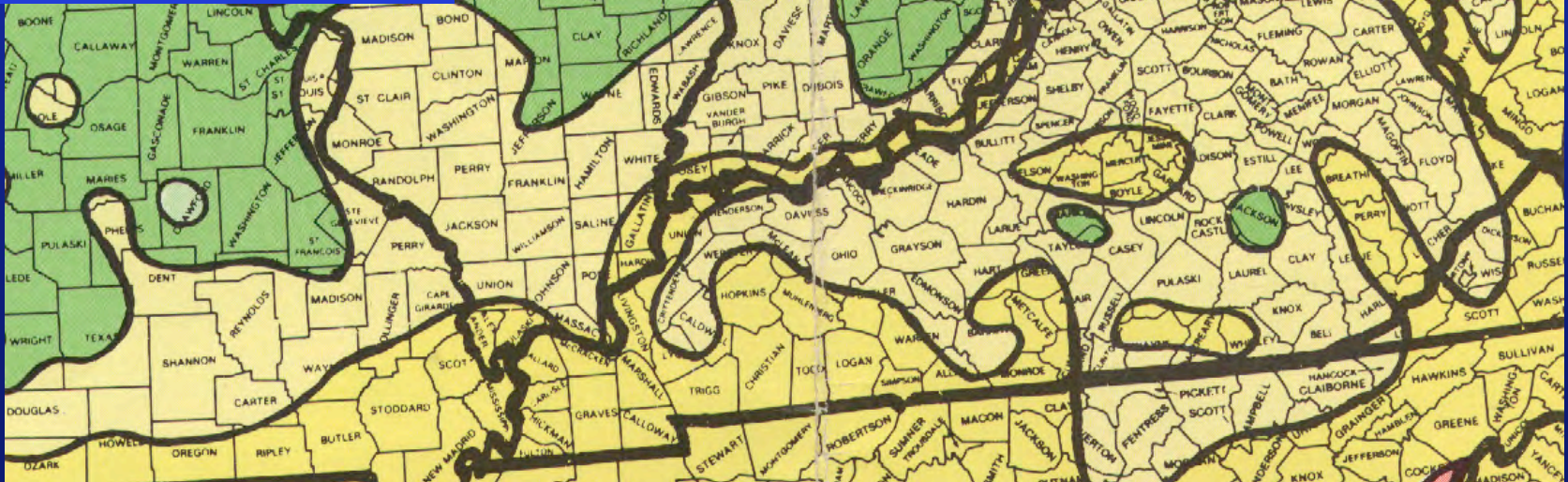
Indiana has zones:

5a (-15 to -20°F)

5b (-10 to -15°F)

6a (-5 to -10°F)

6b (0 to -5°F)



# 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
- **Acceptable sites 5b (-10 to -15°F)**
  - moderately hardy varieties
- **Poor sites 5a (< -15°F)**
  - only hardy varieties

# Cold Damage to Buds



**Live compound bud**



**Dead primary bud**

# Crown Gall



# Crown Gall



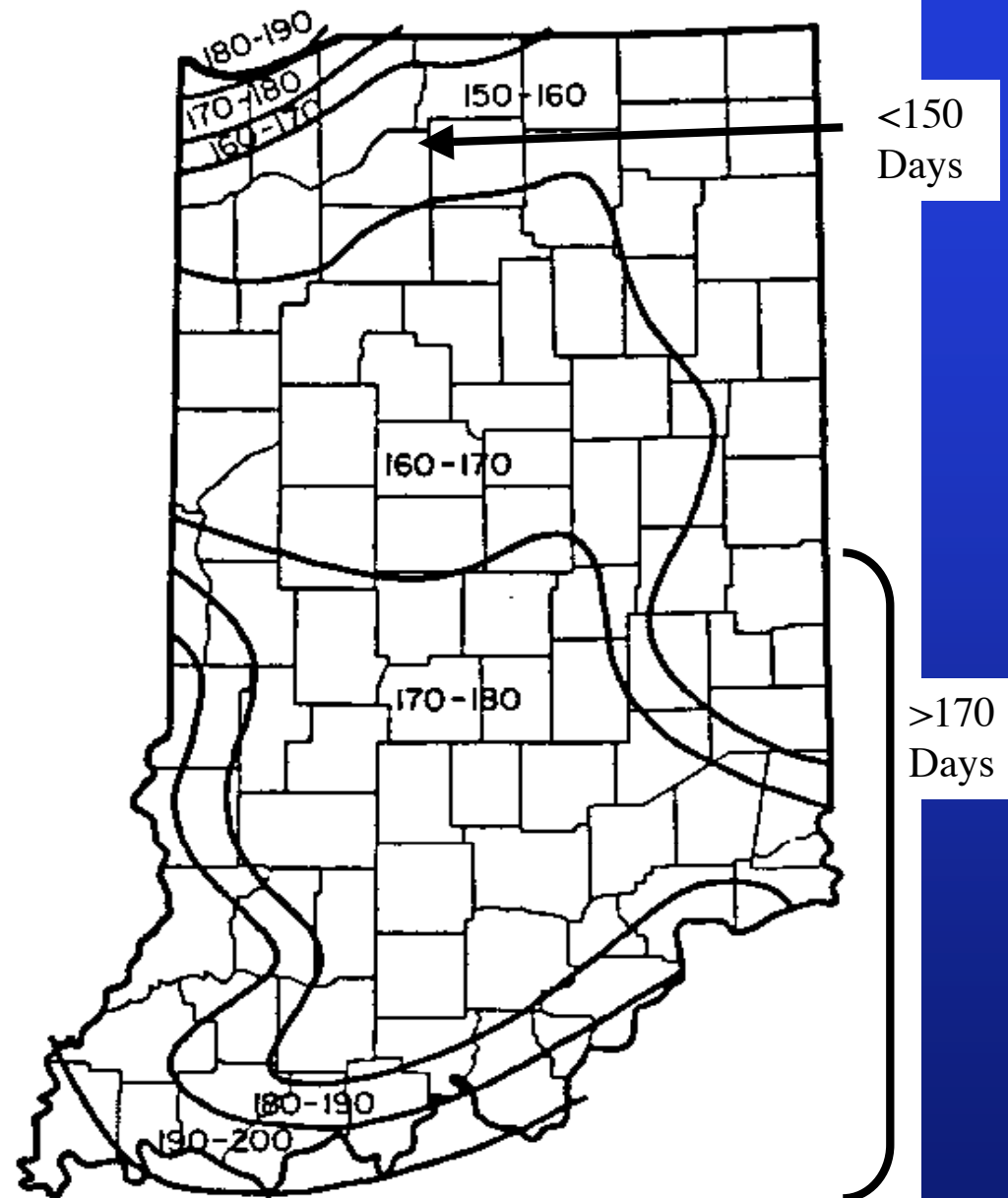
# Length of the growing season and heat accumulation

Indiana season length:  
140 to 200+ days

In general, most varieties need 160-180 days  
(Swenson varieties need less)

Heat units (GDD base 50°F):  
3,800 to 2,500

Varieties vary in adaptation to heat



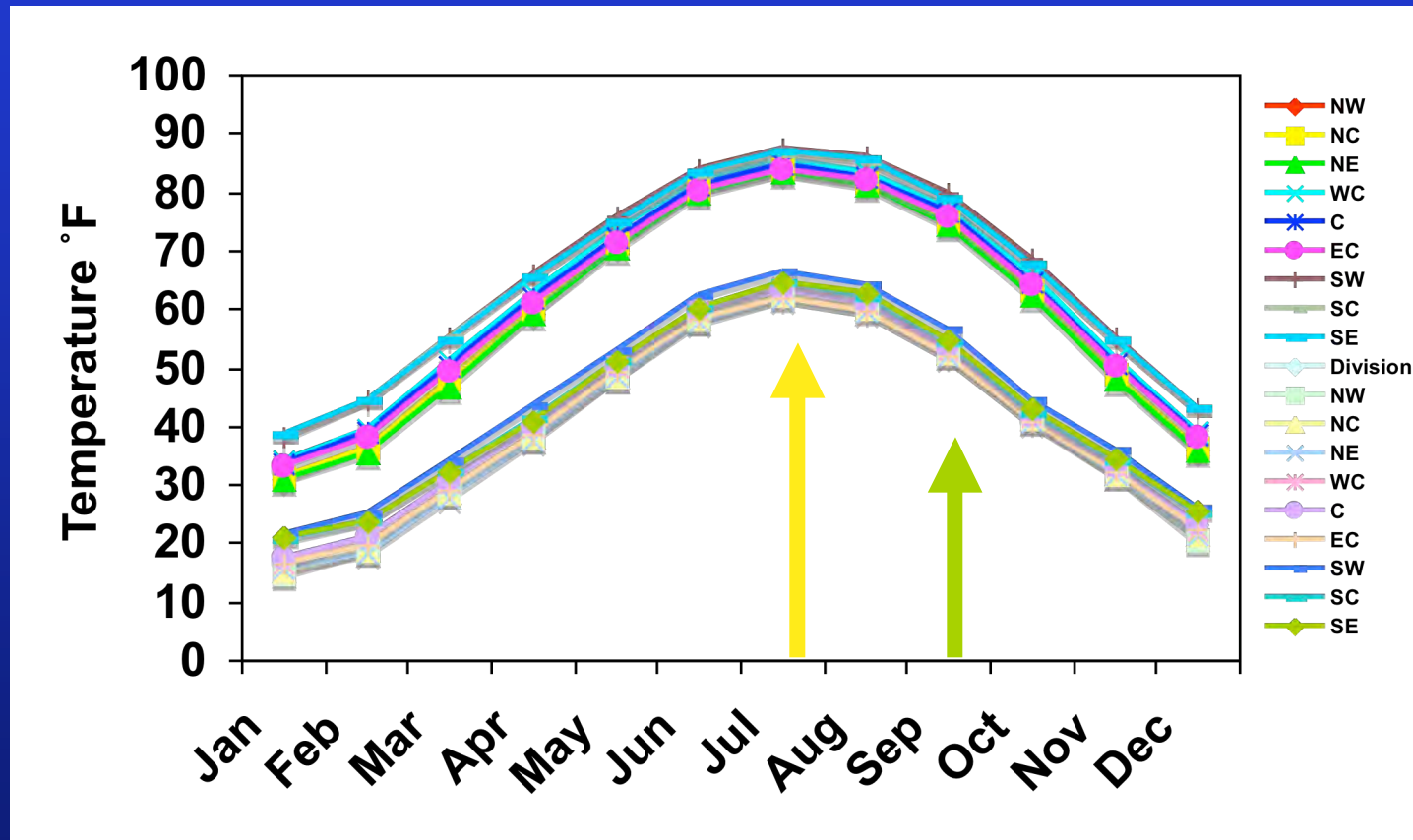
Average length of frost-free seasons in days.

# Temperature During Ripening

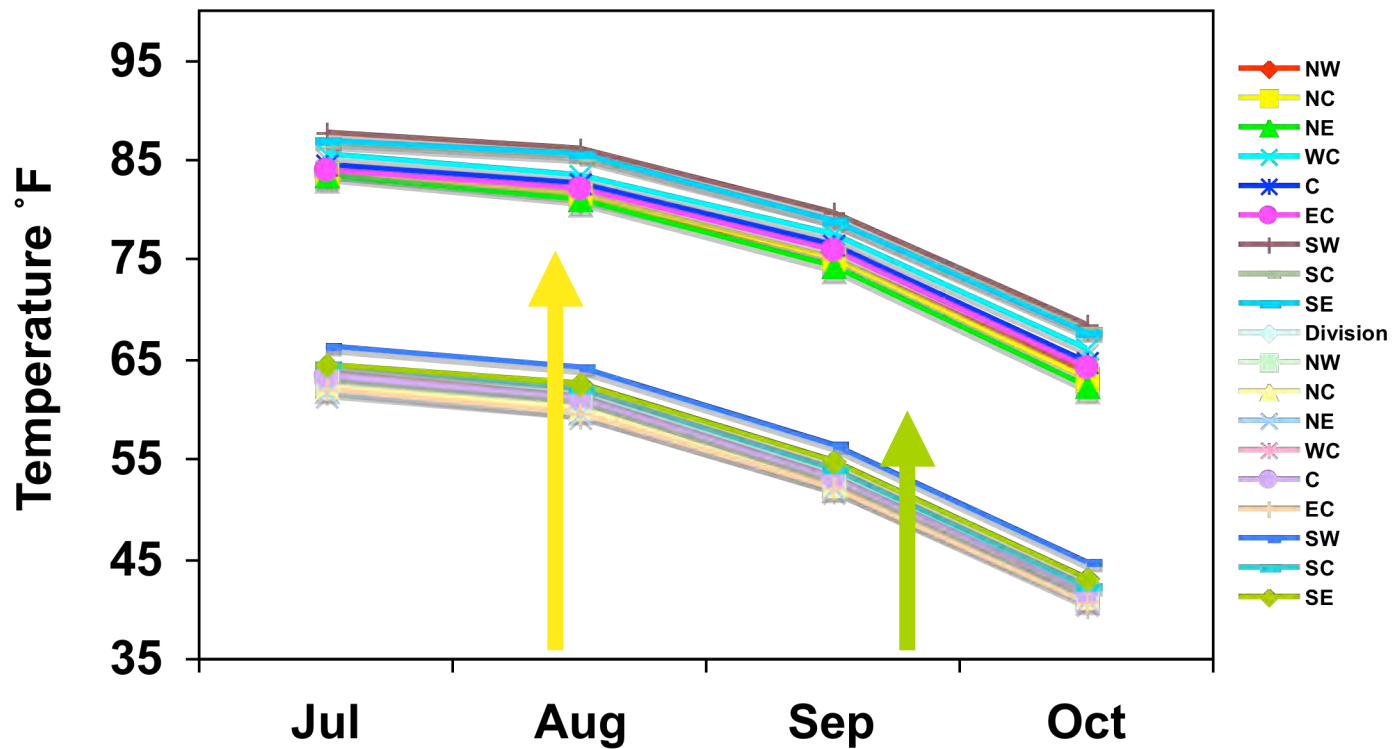
**Fruit quality is best if fruit ripens under warm days and cool nights**

- **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)

# Annual Average Max-Min Temperature



# July-October Max-Min Temperature



# Rainfall During Ripening

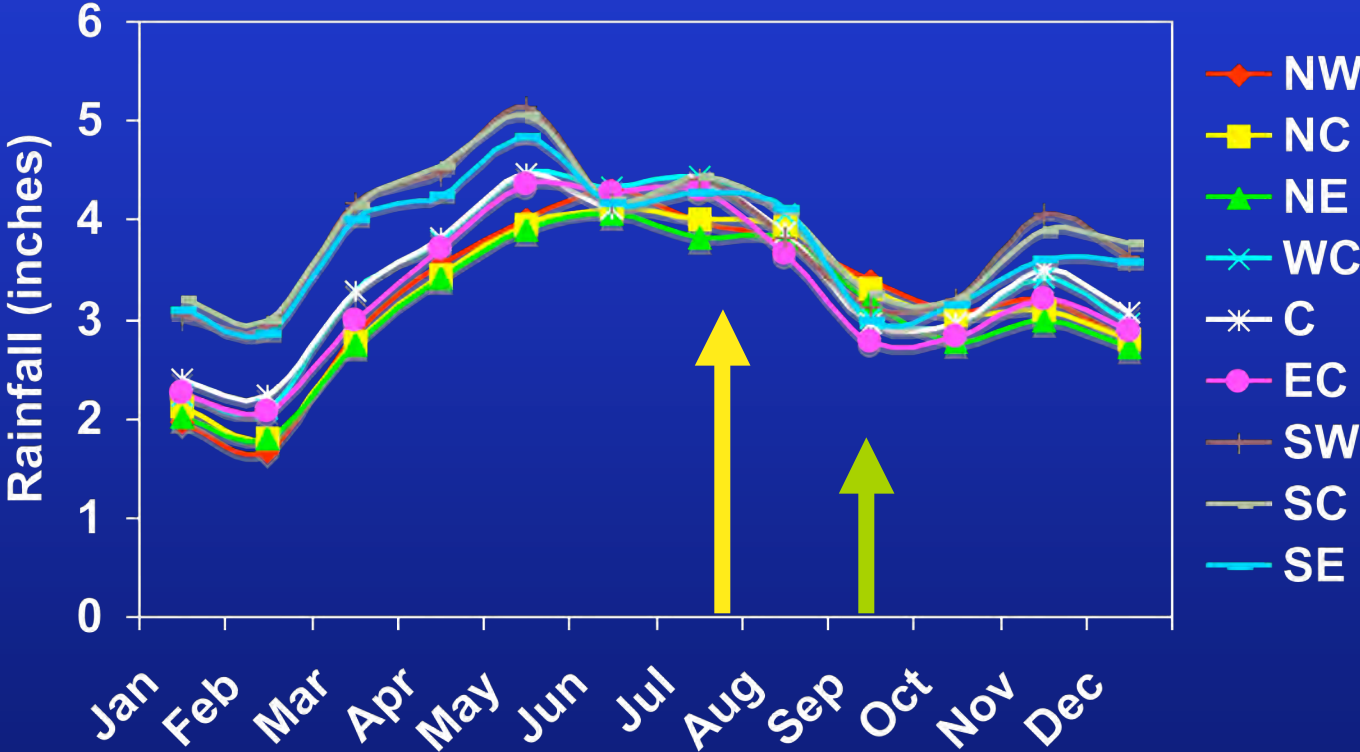
**Rainfall between veraison and harvest almost always leads to a reduction in fruit quality**

- Occurrence of bunch/fruit rots**

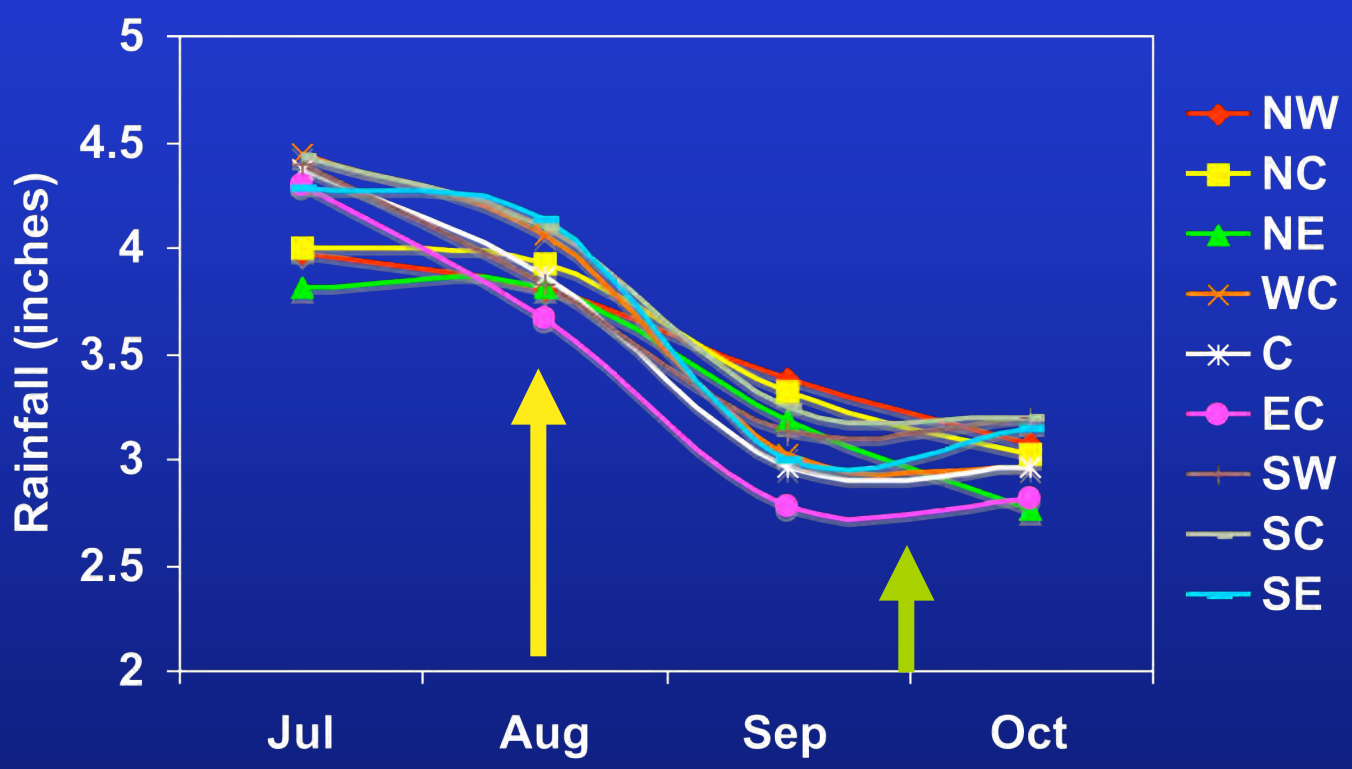
  - Vignoles, Seyval, etc are very prone to bunch rots**

- Dilution of sugar, acid, flavors**

# Average Annual Rainfall in Indiana



# Average July-October Rainfall in Indiana



# **Date of bud break - Frost damage**

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

# 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
- **Late**
  - Chambourcin, Vignoles, Vidal, Steuben, Traminette

# Matching Varieties to Climate

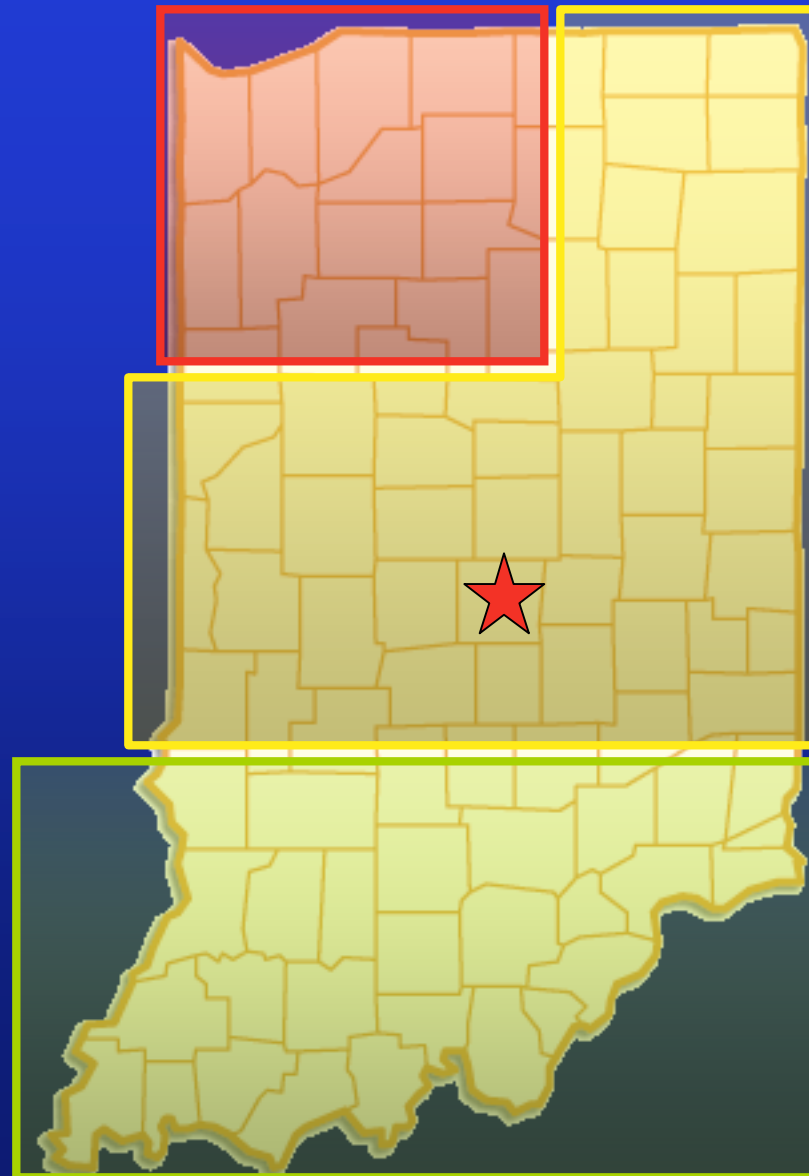
1. Cold hardiness to winter cold
2. Date of bud break / frost risk
3. Date of ripening to temperature and rainfall during veraison to harvest period

# Three “Regions” in Indiana

Cold winter  
short season  
2500 GDD  
relatively cool, dry harvest season

Moderate winter  
medium length season  
3000 GDD  
relatively cool, dry harvest season

Mild winter  
long season  
>3500 GDD  
warm, wet harvest season



# Summary of Matching Varieties to Sites

- **Temperature:**
  - Minimum winter temperature-cold hardiness
  - Temperature range during ripening period is critical for fruit quality
- **Rainfall during ripening**
  - Problems with fruit rots/quality

# Red Wine Grapes for Indiana

- Chambourcin
- Foch & Leon Millot
- Norton
- Frontenac
- Corot noir
- Noiret
- Marquette
- Others?...
- DeChaunac
- Chancellor

# Red Wine Grapes for Indiana

- **Chambourcin**
- **Foch & Leon Millot**
- **Norton**
- **Frontenac**
- **Corot noir**
- **Noiret**
- **Marquette**
- **Others?...**
- **DeChaunac**
- **Chancellor**

## Strengths

- Excellent wine quality, especially if fully ripe
- Late ripening
- Large, loose clusters seldom rot

## Weaknesses

- Only moderately cold hardy
- Needs long growing season
- Low vigor on heavy soils
- Poor nutrition, sensitive to air pollution
- May need crop control

# Red Wine Grapes for Indiana

- Chambourcin
- Foch & Leon Millot
- Norton
- Frontenac
- Corot noir
- Noiret
- Marquette
- Others?...
- DeChaunac
- Chancellor

## Strengths

- Good wine quality
- Cold hardy
- Early ripening
- Moderately disease resistant

## Weaknesses

- Very early bud break and ripening
- Very sensitive to 2,4-D
- Low vigor on heavy soils

# Red Wine Grapes for Indiana

- Chambourcin
- Foch & Leon Millot
- **Norton**
- Frontenac
- Corot noir
- Noiret
- Marquette
- Others?...
- DeChaunac
- Chancellor

## Strengths

- Good wine quality
- Cold hardy
- Late ripening
- Very disease resistant

## Weaknesses

- Needs long growing season
- Low yields, high vigor
- High acid, high pH
- Drought susceptible

# Red Wine Grapes for Indiana

- Chambourcin
- Foch & Leon Millot
- Norton
- **Frontenac**
- Corot noir
- Noiret
- Marquette
- Others?...
- DeChaunac
- Chancellor

## Strengths

- Good wine quality
- Very cold hardy
- Mid-season ripening
- Moderately disease resistant
- High sugar

## Weaknesses

- Very high acid, long hang time may not help
- Bird damage
- Very susceptible to leaf phylloxera
- Poor fruit set

# Red Wine Grapes for Indiana

- Chambourcin
- Foch & Leon Millot
- Norton
- Frontenac
- **Corot noir**
- Noiret
- Marquette
- Others?...
- DeChaunac
- Chancellor

## Strengths

- Good wine quality
- Moderately cold hardy
- Mid-season ripening
- Loose clusters, tough skin, few rots (except Phomopsis)

## Weaknesses

- Susceptible to downy mildew and Phomopsis
- Can be very vigorous
- Tendency to produce many “summer” clusters.... 2-4 sets

# Red Wine Grapes for Indiana

- Chambourcin
- Foch & Leon Millot
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- Frontenac
- Corot noir
- **Noiret**
- Marquette
- Others?...
- DeChaunac
- Chancellor

## Strengths

- Good wine quality
- Cold hardy
- Mid-late season ripening
- Loose clusters, tough skin, few rots

## Weaknesses

- Can be very vigorous

# Red Wine Grapes for Indiana

- Chambourcin
- Foch & Leon Millot
- Norton
- Frontenac
- Corot noir
- Noiret
- **Marquette**
- Others?...
- DeChaunac
- Chancellor

## Strengths

- Good wine quality
- Very cold hardy
- Early-mid season ripening

## Weaknesses

- Early veraison, bird damage
- Poor fruit set?

# Red Wine Grapes for Indiana

- Chambourcin
- Foch & Leon Millot
- Norton
- Frontenac
- Corot noir
- Noiret
- Marquette
- Others?...
- **DeChaunac**
- Chancellor

## Strengths

- Moderate wine quality
- Cold hardy
- Mid-season ripening
- Very productive

## Weaknesses

- Very susceptible to Phomopsis
- Excessive number of clusters and non-count shoots, thinning required
- Early bud break

# Red Wine Grapes for Indiana

- Chambourcin
- Foch & Leon Millot
- Norton
- Frontenac
- Corot noir
- Noiret
- Marquette
- Others?...
- DeChaunac
- **Chancellor**

## Strengths

- Moderate wine quality
- Cold hardy
- Mid-season ripening
- Very productive, even on secondary buds

## Weaknesses

- Very susceptible to downy mildew
- Tight clusters
- Early-mid season maturity

# Red Wine Grapes for Indiana

- Chambourcin
  - Foch
  - Norton
  - Frontenac
  - DeChaunac
  - Chancellor
  - Corot noir
  - Noiret
  - Marquette
  - Leon Millot
  - **Others...**
- GR-7  
St. Croix  
Baco noir  
Chelois  
Rougeon  
Rosette  
.....?

# Vinifera Wine Grapes for Indiana

## Red vinifera

Cabernet sauvignon  
Cabernet franc  
Lemberger

Pinot noir?  
Petit Verdot?  
Malbec?  
Tannat?  
Marselan?

## Strengths

Excellent wine quality if fully ripe

## Weaknesses

Cold tender  
Disease susceptible  
Vigorous and difficult to manage  
Late ripening, need long season for good quality  
Lack of experience

# White Wine Grapes for Indiana

- Traminette
- Chardonel
- Cayuga White
- Seyval
- Vidal
- Vignoles
- LaCrosse
- LaCrescent
- Valvin Muscat
- Others...

# White Wine Grapes for Indiana

- Traminette
- Chardonee
- Cayuga White
- Seyval
- Vidal
- Vignoles
- LaCrosse
- LaCrescent
- Valvin Muscat
- Others...

## Strengths

- Excellent wine quality
- Moderately cold hardy
- Moderate disease resistance
- Not overly productive
- Late ripening

## Weaknesses

- Excess vigor can lead to poor fruit quality.... shading
- Only moderate cold hardiness, especially trunk damage in young vines
- Moderate disease resistance... susceptible to Phomopsis

# White Wine Grapes for Indiana

- Traminette
- **Chardone**
- Cayuga White
- Seyval
- Vidal
- Vignoles
- LaCrosse
- LaCrescent
- Valvin Muscat
- Others...

## Strengths

- Good wine quality
- Not overly productive (e.g. Seyval)
- Moderate disease resistance
- Mid to late season ripening

## Weaknesses

- Only moderately cold hardy
- Moderate disease resistance... susceptible to Phomopsis
- Less prone to bunch rots than Seyval, but still a problem

# White Wine Grapes for Indiana

- Traminette
- Chardone1
- **Cayuga White**
- Seyval
- Vidal
- Vignoles
- LaCrosse
- LaCrescent
- Valvin Muscat
- Others...

## Strengths

- Good wine quality
- Good disease resistance
- Large, loose clusters, large berries, not prone to bunch rots
- Mid-season ripening
- High yield potential

## Weaknesses

- Only moderately cold hardy, especially canes and cordons
- Susceptible to Phomopsis on cluster stems
- Very vigorous, large upright shoots can suffer wind damage

# White Wine Grapes for Indiana

- Traminette
- Chardonei
- Cayuga White
- **Seyval**
- Vidal
- Vignoles
- LaCrosse
- LaCrescent
- Valvin Muscat
- Others...

## Strengths

- Good wine quality
- Moderately cold hardy
- Mid-season ripening

## Weaknesses

- Excessively productive (non-count shoots, large clusters)
- Susceptible to bunch rots
- Low vigor, especially on heavy soils or replant sites

# White Wine Grapes for Indiana

- Traminette
- Chardonei
- Cayuga White
- Seyval
- **Vidal**
- Vignoles
- LaCrosse
- LaCrescent
- Valvin Muscat
- Others...

## Strengths

- Good wine quality
- Loose clusters, tough skin, resist fruit rots
- Late ripening

## Weaknesses

- Only moderately cold hardy
- Large clusters may need thinning
- Late ripening

# White Wine Grapes for Indiana

- Traminette
- Chardone1
- Cayuga White
- Seyval
- Vidal
- **Vignoles**
- LaCrosse
- LaCrescent
- Valvin Muscat
- Others...

## Strengths

- Excellent wine quality, especially as late harvest
- Moderately cold hardy
- Mid-season ripening\*
- Good acidity in cool areas for late harvest

## Weaknesses

- Very tight clusters, fruit rots common, especially Botrytis
- Fruit quality concerns in southern areas (rots, early harvest\*)
- Low yields

# White Wine Grapes for Indiana

- Traminette
- Chardonei
- Cayuga White
- Seyval
- Vidal
- Vignoles
- **LaCrosse**
- LaCrescent
- Valvin Muscat
- Others...

## Strengths

- Good wine quality
- Very cold hardy
- Mid-season ripening
- Good vigor and yields

## Weaknesses

- Very susceptible to diseases
- Small, tight clusters

# White Wine Grapes for Indiana

- Traminette
- Chardone1
- Cayuga White
- Seyval
- Vidal
- Vignoles
- LaCrosse
- **LaCrescent**
- Valvin Muscat
- Others...

## Strengths

- Good wine quality
- Very cold hardy
- Mid-season ripening
- Loose clusters, small berries, fruit rots not a problem

## Weaknesses

- Very early bud break
- High acidity
- Very susceptible to leaf phylloxera

# White Wine Grapes for Indiana

- Traminette
- Chardone1
- Cayuga White
- Seyval
- Vidal
- Vignoles
- LaCrosse
- LaCrescent
- **Valvin Muscat**
- Others...

## Strengths

- Good wine quality-clean muscat flavor
- Moderately cold hardy
- Mid-season ripening

## Weaknesses

- Only moderately cold hardy
- Weak vines, need to be grafted
- Very tight, small clusters
- Very short internodes
- “Muscat spot” disorder

# White Wine Grapes for Indiana

- Traminette
  - Chardone1
  - Cayuga White
  - Seyval
  - Vidal
  - Vignoles
  - LaCrosse
  - LaCrescent
  - Valvin Muscat
  - Others...
- Melody
  - Horizon
  - Aurore
  - Ventura
  - Villard blanc
  - Frontenac gris
  - Niagara
  - Delaware
  - Dutchess
  - Golden muscat
  - .....?

# Vinifera Wine Grapes for Indiana

## White vinifera

Chardonnay

Riesling

Pinot gris

## Strengths

Excellent wine quality

## Weaknesses

Cold tender

Disease susceptible

Lack of experience

# Summary

- **Match best varieties to best sites**
  - Vinifera (esp. reds) where possible
- **Strive for premium quality**
  - From all varieties....