Viticulture, enology and marketing for cold-hardy grapes

# Performance of Marquette, Frontenac, and La Crescent in Northern Grapes Project Viticulture Trials

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# What we know about Northern Hybrids

1. Many can withstand winter temperatures as low as -40 F.
2. Many exhibit very vigorous vegetative growth.
3. Juice from the grapes can be:
   a. Very high in % soluble solids ($^{o}$Brix).
   b. Very high in titratable acids (TA)
   c. Juice pH tends to rise rapidly during berry maturation.
   d. Juice has a different profile of malic to tartaric acid that other grapes.
   e. Juice can be high in potassium (K).
   f. Red wine cultivars are often very high in anthocyanin pigments.
4. Wines made from these grapes can often have an "herbaceous" or "grassy" character.

# What we know about Grapevine Physiology

**Symptoms associated with grapes grown in overly shaded canopies:**

- **Levels of titratable acids remain high.**
- **Juice pH rises rapidly during berry maturation.**
- **Juice can be high in potassium (K).**
- **Juice has a different profile of malic to tartaric acid.**
- **Wines made from the grapes have an "herbaceous" or "grassy" character.**

***Can vineyard management practices improve the quality of fruit from cold climate cultivars?***

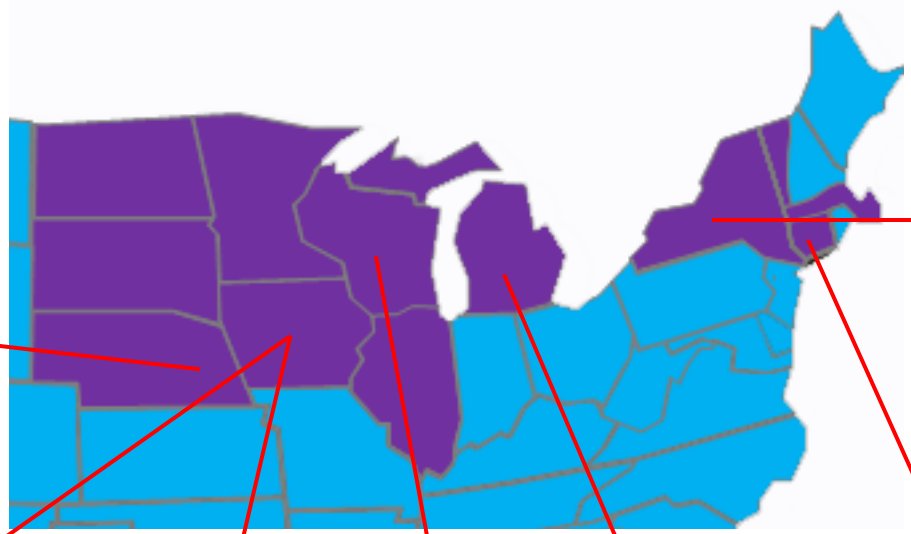
# Objective 2

**Develop and extend research-based vineyard management practices that allow sustained production of high quality fruit from cold climate cultivars.**

- **Obj. 2a. Evaluate crop and canopy management strategies to minimize fruit acid content and improve fruit composition in high-acid cold climate grape cultivars.**
  - i. Training systems
  - ii. Canopy management
  - iii. Cropping level management

# Viticulture Team

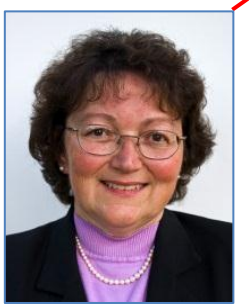
## Objective 2a



Paul Read

Tim Martinson*

Chrislyn Particka



Gail Nonnecke

Paul Domoto

Rebecca Harbut

Paolo Sabbatini

Bill Nail

# Objective 2a
# Approaches

## i. Identify training systems suited to cold climate grape cultivars.

- Comparing vine performance, yield, light interception, disease incidence, and fruit composition in replicated trials.

| State | CT | NY | IA | NE | MI | WI |
|---|---|---|---|---|---|---|
| Coop. | Bill Nail | Tim Martinson | Gail Nonnecke<br>Paul Domoto | Paul Read | Paolo Sabatini | Rebecca Harbut |
| Training systems | HWC<br>(Hudson River Umbrella)<br>MWC/VSP<br>GDC<br>Scott Henry | HWC<br>MWC/VSP<br>Umbrella Kniffin | HWC<br>MWC/VSP<br>GDC<br>Scott Henry | HWC<br>MWC/VSP<br>GDC<br>Smart-Dyson<br>Scott Henry | HWC<br>GDC | ? |
| Cultivars | St. Croix | Frontenac<br>Marquette<br>La Crescent | Frontenac<br>Marquette<br>La Crescent | Frontenac<br>St. Croix | Frontenac<br>Marquette<br>La Crescent<br>St. Croix | Frontenac<br>Marquette<br>La Crescent |
| Status | Established | Conversion year | Conversion year | Established | Conversion year | Planted 2012 |

Abbreviations: HWC= high wire cordon; MWC=mid-wire cordon; GDC= Geneva double curtain

# Objective 2a
# Approaches

## ii. Canopy management.

***Will modifying the light environment through canopy management practices improve fruit and wine making characteristics?***

- Shoot thinning
  - Early season: double & basal shoots
  - Mid-season: Axillary (lateral) shoots
- Shoot positioning
- Summer hedging
- Leaf removal

**Team:** **IA -** Gail Nonnecke & Paul Domoto
**WI -** Rebecca Harbut (WI)

# Objective 2a
## Approaches

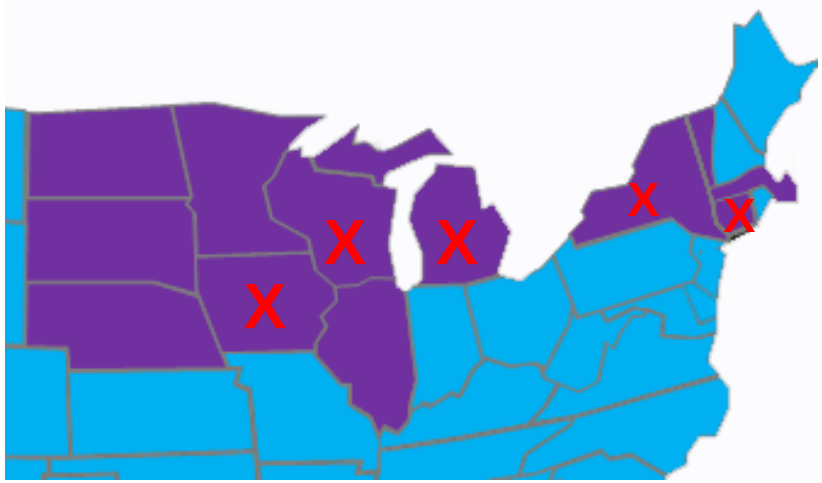
### iii. Cropping level management.

***Under what conditions will crop thinning moderate acidity and assist growers in avoid delays in ripening?***

a. Crop load adjustment:
   - **IA -** Gail Nonnecke & Paul Domoto

b. Timing and severity of crop reduction.
   - **NY -** Tim Martinson & Chrislyn Particka

# 2012 Spring Frosts




Marquette

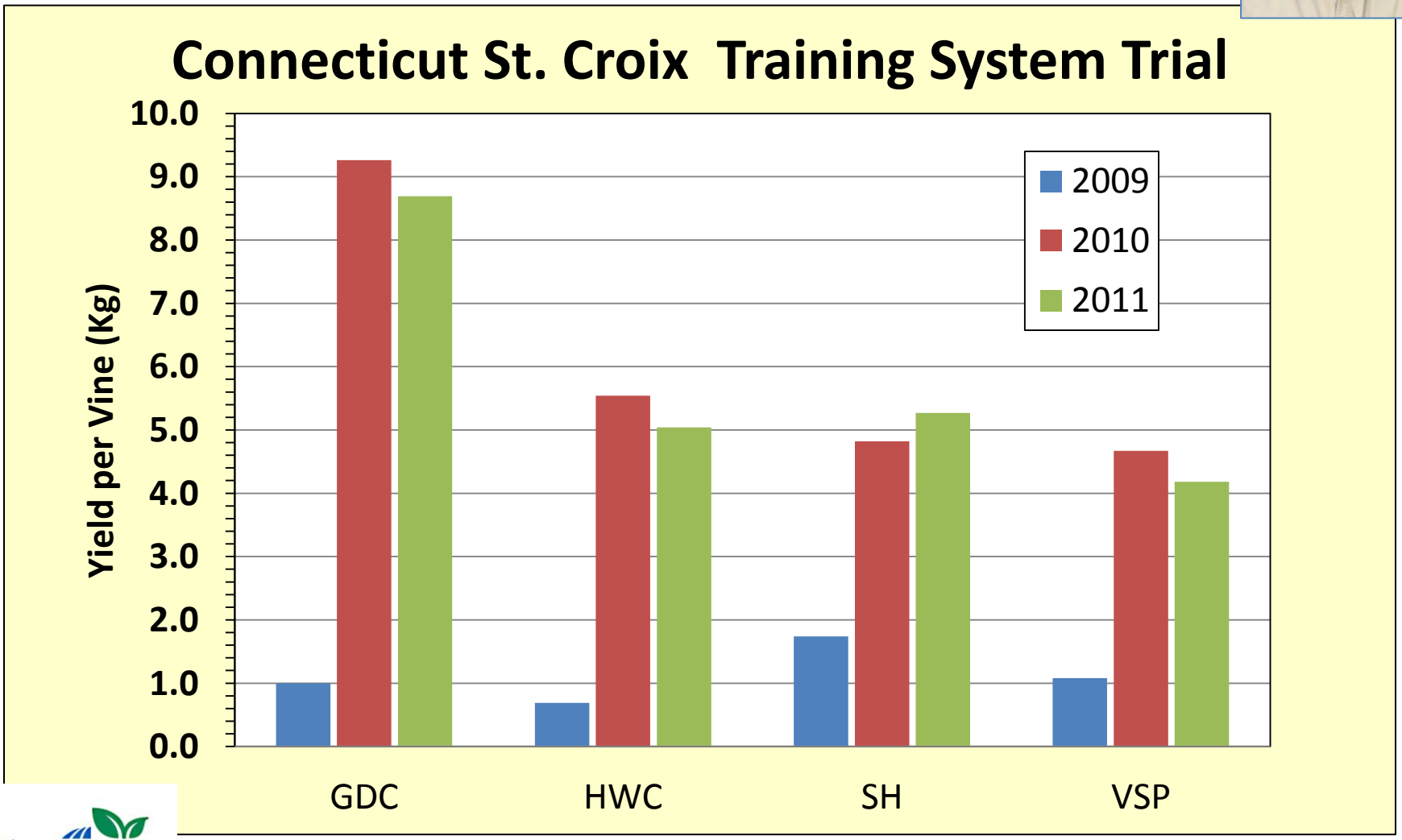
| NE-1020 plot – Ames IA<br>11 April freeze (20.5 F) | | | | |
|---|---|---|---|---|
| | 50% Bud burst | Shoot Dev. | % Live 1° shoots | Yield/ vine (lb) |
| Marquette | 30 Mar | 3rd leaf | 15 | 2.8 |
| La Crescent | 2 Apr | 2nd leaf | 30 | 4.3 |
| St. Croix | 2 Apr | 2nd leaf | 43 | 8.0 |
| Frontenac | 7 Apr | 1st leaf | 72 | 10.9 |

# Objective 2a
## Outcomes in 2012

| State | Status in 2012 |
|---|---|
| **i. Training Systems** | |
| CT | Established plot. No crop |
| NY | Conversion year. Some crop, some data collected |
| MI | Conversion year. Insufficient crop to collect data |
| IA | Conversion year. Insufficient crop to collect data |
| NE | Established plot. Not affected by frost. |
| **ii. Canopy Management** | |
| IA | Some crop, study conducted on Frontenac & La Crescent, but not Marquette. |
| **iii Cropping level management** | |
| NY | Thinned Frontenac. Evaluated thinning effect of frost on La Crescent |
| IA | Insufficient crop to conduct the study |

USDA NIFA

# Objective 2a
## ii Training systems



# Objective 2a
## ii Training systems

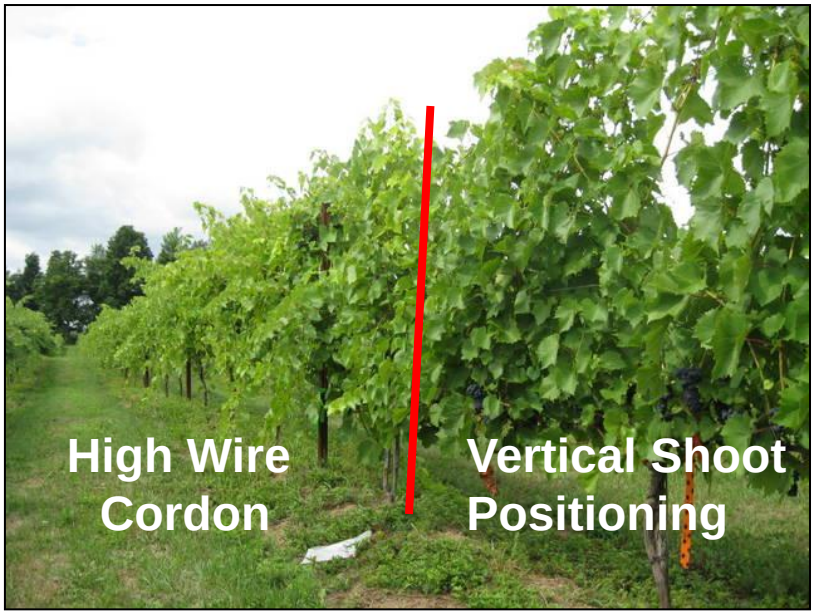
## Connecticut:

| System | °Brix | | | pH | | | TA (g/L) | | |
|---|---|---|---|---|---|---|---|---|---|
| | 2009 | 2010 | 2011 | 2009 | 2010 | 2011 | 2009 | 2010 | 2011 |
| GDC | 16.7 | 20.3 | 15.1 | 3.43 | 3.48 | 3.75 b | 9.3 ab | 5.6 | 6.0 |
| HWC | 16.5 | 20.4 | 15.6 | 3.39 | 3.47 | 3.77 ab | 10.0 a | 5.6 | 6.2 |
| SH | 16.1 | 20.0 | 15.0 | 3.39 | 3.48 | 3.77 ab | 8.8 b | 5.6 | 6.0 |
| VSP | 16.7 | 20.0 | 15.3 | 3.44 | 3.52 | 3.81 a | 8.9 ab | 5.8 | 6.4 |
| | *ns* | *ns* | *ns* | *ns* | *ns* | | | *ns* | *ns* |

# Objective 2a
# ii Training systems

## New York:

- Site: Coyote Moon Vineyards, Clayton
- Cultivars: Frontenac, Marquette
- Training Systems: High wire cordon, Mid-wire cordon/VSP, Umbrella kniffin
- Conversion year: Frontenac was HWC; Marquette was VSP




# New York Training Systems

## Shoot Counts Before Shoot Thinning

Total shoots =
First Shoot (count) + 2nd Shoot (count) + Base (noncount) buds

## Frontenac

| Treatment | Nodes | First shoot | Double/vine | Base buds | Shoots | Shoot/node | % Shootless |
|---|---|---|---|---|---|---|---|
| High Cordon* | 34.2 | 28.9 | 4.8 | 11.1 | 44.8 | 1.3 | 14.4% |
| VSP | 34.3 | 25.5 | 2.5 | 12.4 | 40.4 | 1.2 | 24.3% |
| Umbrella | 35.1 | 29.9 | 8.9 | 9.0 | 47.7 | 1.4 | 13.1% |

## Marquette

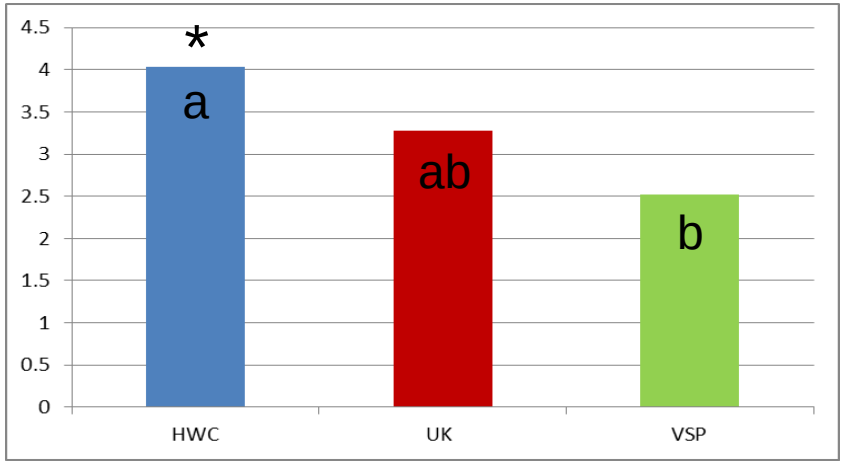
| Treatment | Nodes | First shoot | Double/vine | Base buds | Shoots | Shoot/node | % Shootless |
|---|---|---|---|---|---|---|---|
| High Cordon | 23.4 | 17.7 | 0.5 | 1.5 | 19.6 | 0.8 | 25.2% |
| VSP * | 33.6 | 26.6 | 0.2 | 14.7 | 41.5 | 1.3 | 17.9% |
| Umbrella | 29.7 | 24.0 | 0.5 | 1.3 | 25.9 | 1.2 | 0.0% |

* Original training system

# New York Training Systems

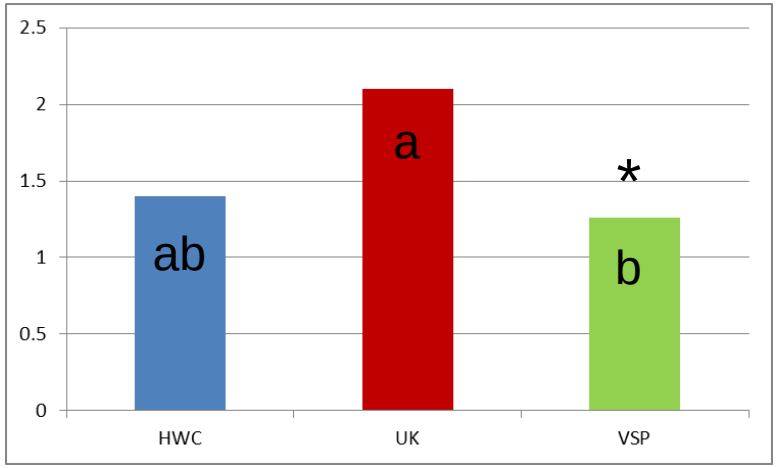
## 2012 Yield

### Frontenac




Tons/Acre

### Marquette




Tons/Acre

* Original system

**K deficiency**

on Frontenac

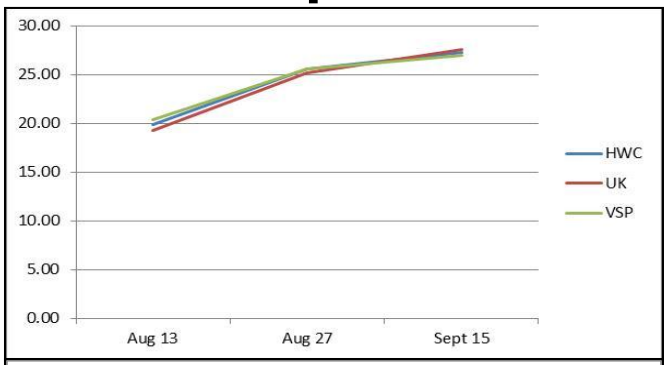
# New York Training Systems

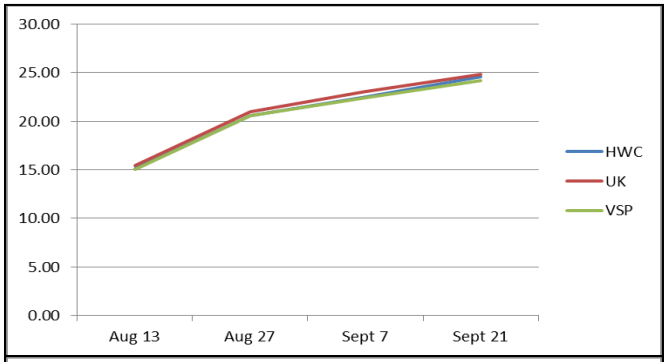
## Maturity Indices

### Marquette

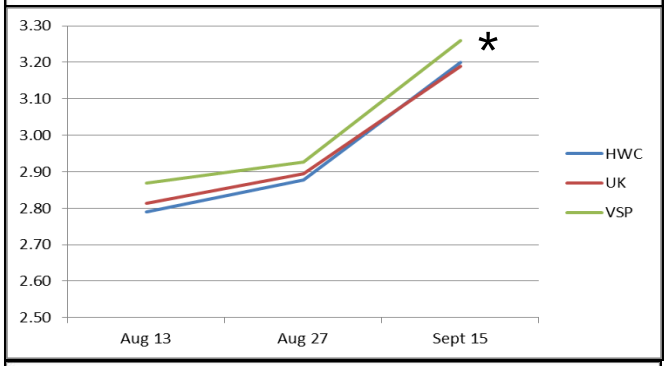
### Frontenac

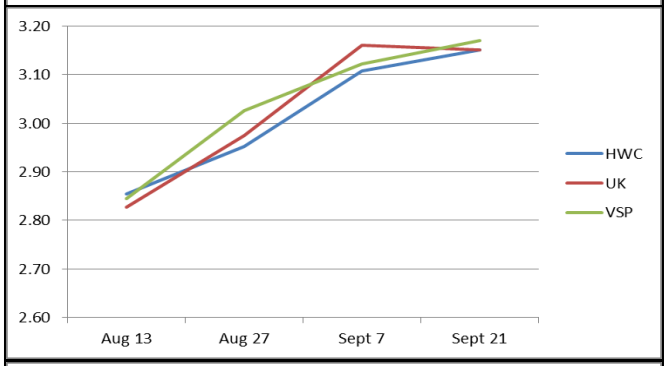
**°Brix**



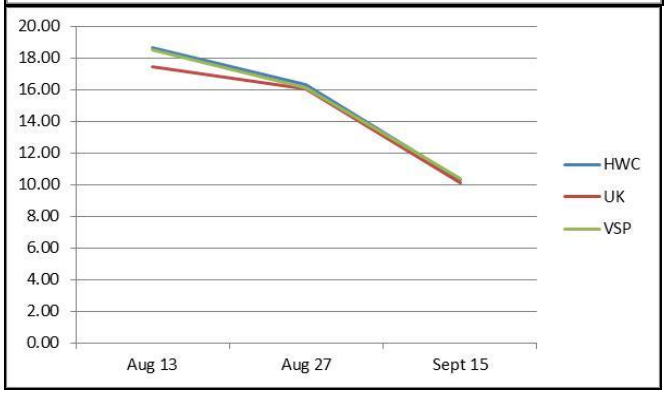



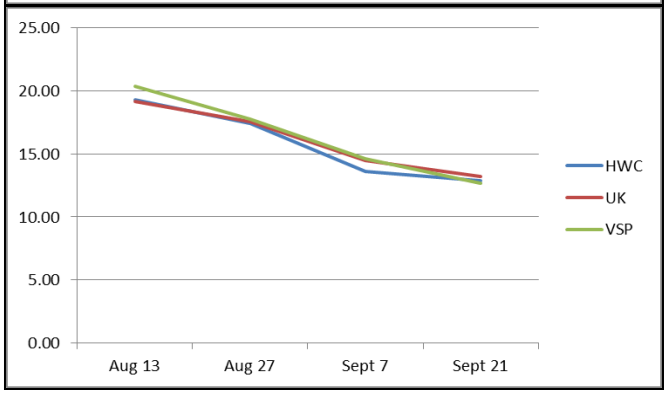

**pH**



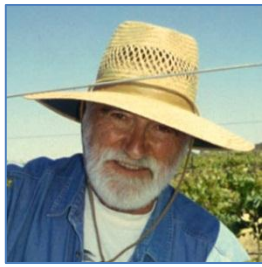




**TA**



# Nebraska Training Systems



- **Cultivars:** Frontenac, St. Croix
- **Systems:** HWC, MWC/VSP, GDC, Smart Dyson, Scott Henry, (PRS)

**HWC**

**MWC/VSP**

**GDC**

**Scott Henry**

**(PRS)**

# Iowa Training Systems

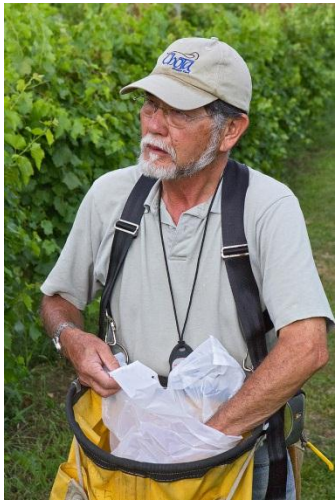
- Conversion year (from HWC)
- Cultivars: Frontenac, La Crescent, Marquette
- Systems: HWC, MWC/VSP, GDC, Scott Henry (or Smart Dyson)?
- Vineyards: Snus Hill, Madrid; Hickory Creek, Adel

# Objective 2a

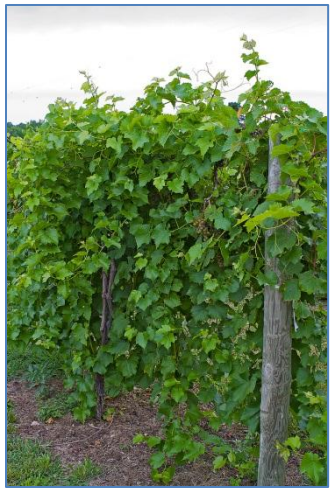
## ii Canopy Management

## Iowa:

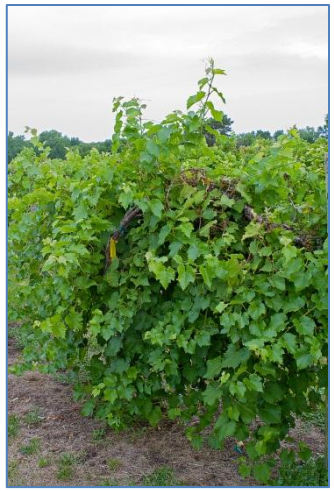
- **Dylan Rolfes**, graduate student, Drs Gail Nonnecke & Paul Domoto
  - Under Grads: Danika Schaaf & Hanna Wallace
- **Cultivars/ Vineyard in 2012:**
  - **Frontenac**: Penoach Vineyards, Adel
  - **La Crescent**: Snus Hill, Madrid
- **Treatments:** all combinations of:
  - Pre-bloom shoot thinning
  - Post-bloom shoot positioning
  - Axillary (lateral) shoot thinning in the fruiting zone.
- **Data:**
  - Time to perform tasks including harvest
  - Canopy light quality (PAR) & Point Quadrat Analysis (PQA)
  - Yield
  - Fruit quality indices



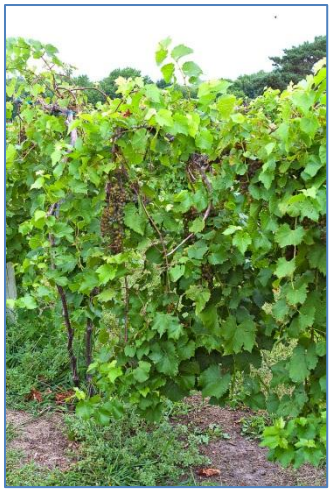
# Iowa Canopy Management Treatments



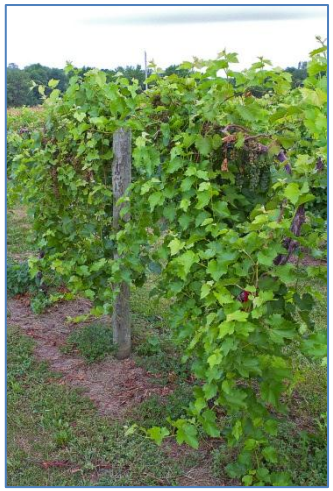
Control



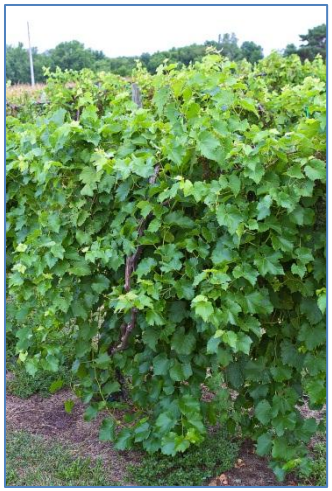
SP



ST

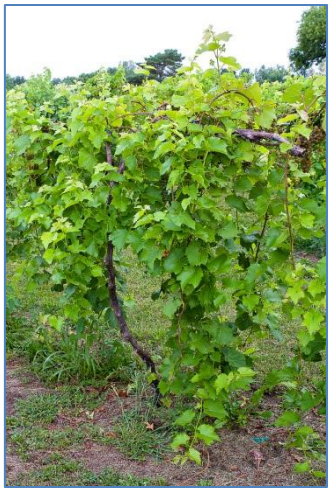


LT



ST + SP

SP + LT

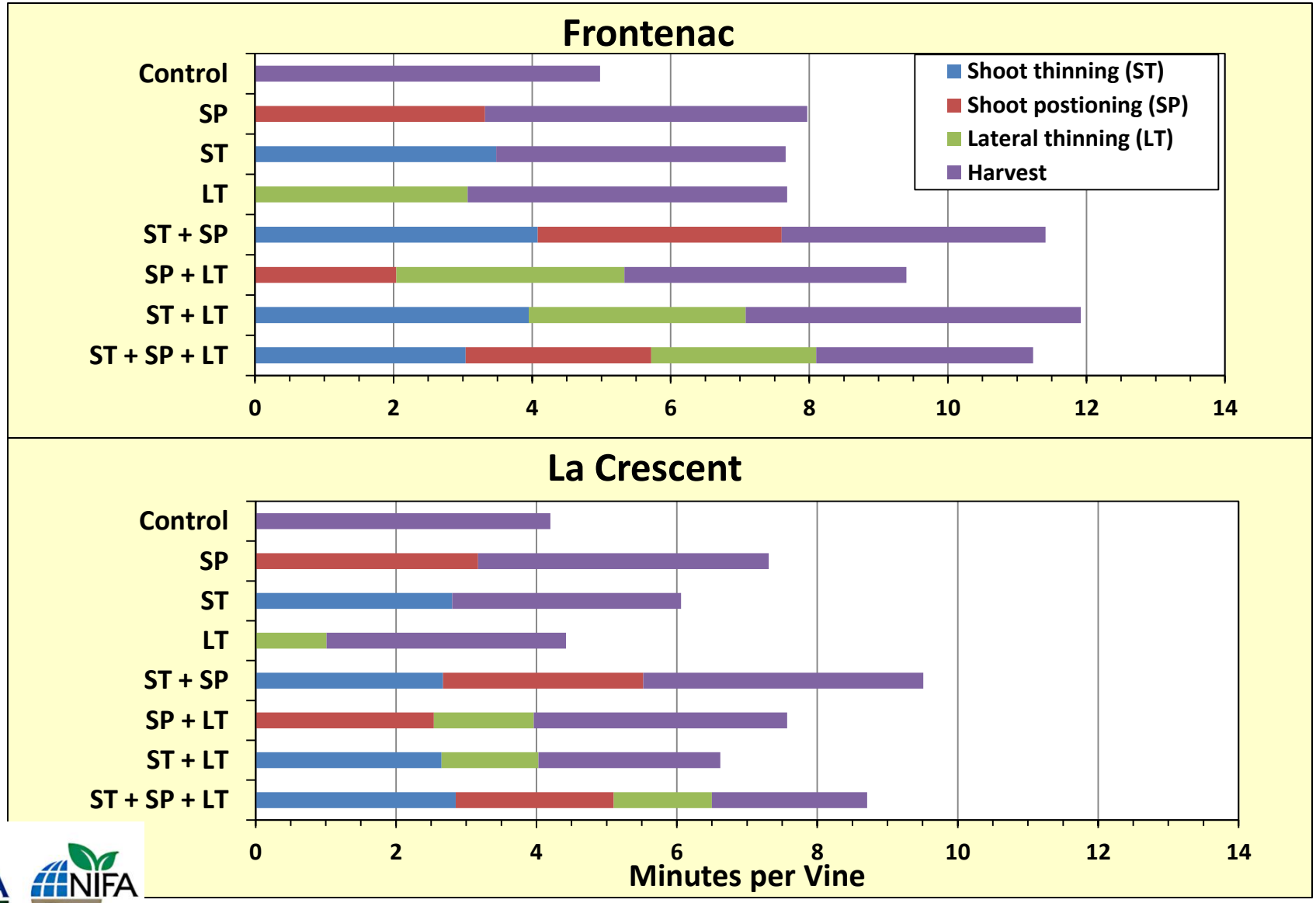


ST + LT

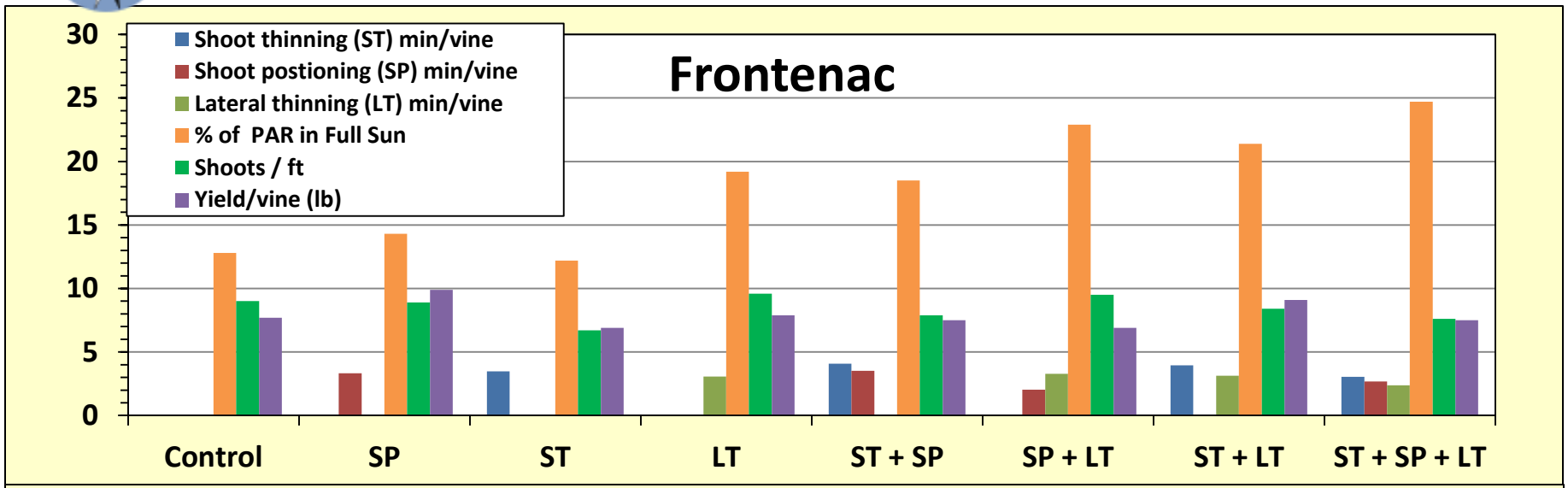
ST + SP + LT

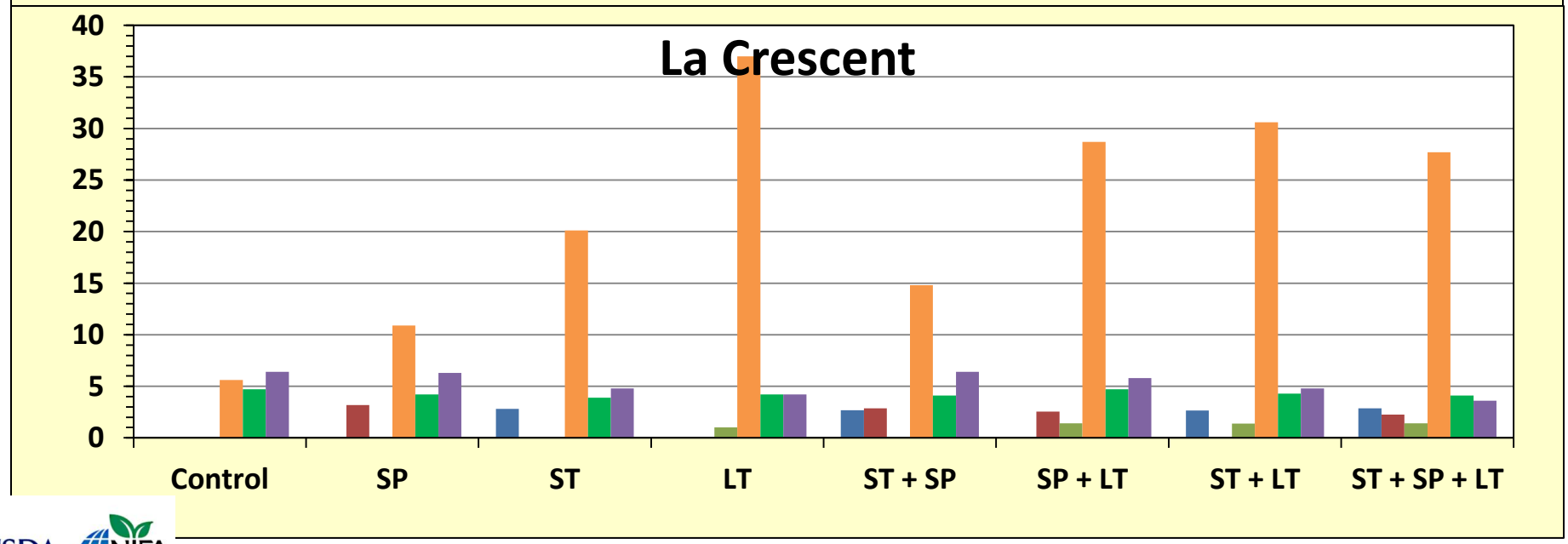
# Iowa Canopy Management

## Time to perform tasks



# Iowa Canopy Management – % PAR



# Objective 2a

## iii. Cropping level management

## New York Thinning Study at Coyote Moon:

- Frontenac (planned in La Crescent)
  - Pre-bloom
    - Heavy (thin to 1 cluster/shoot)
    - Moderate (remove 6 clusters)
  - At fruit set
    - Heavy (thin to 1 cluster/shoot)
    - Moderate (remove 6 clusters)
  - Green Harvest
    - Remove lagging clusters at veraison
  - Control
- 4 reps, 3-panel plots, data collected on middle 7 vines

# Objective 2a

## iii. Cropping level management.

**New York Thinning Study at Coyote Moon:**

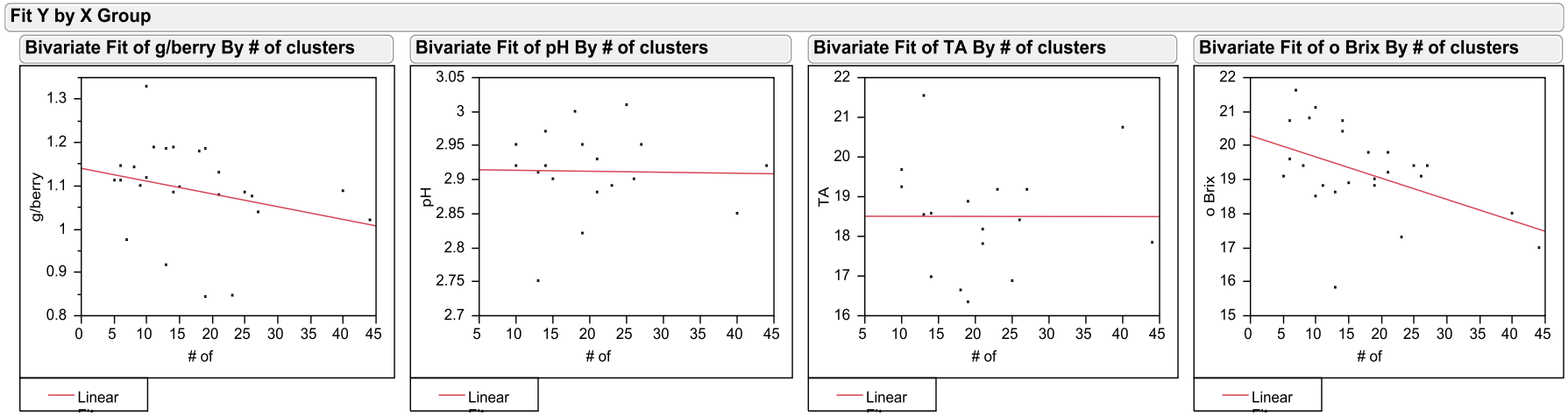
- However:
  - Severe frost/freeze damage in La Crescent prevented study from occurring due to extremely light crop
    - Tagged 25 vines with varying crop, recorded fruit chemistry and yield.
  - Frost/freeze damage in Frontenac meant a somewhat reduced crop, plus very warm weather conditions resulted in good fruit chemistry overall.
  - Severe potassium deficiency.

# Objective 2a

## iii. Cropping level management.

**New York Thinning Study at Coyote Moon:**

- La Crescent 'Crop Load' August 13 2012




| Berry wt. | pH | TA | °Brix |
|---|---|---|---|
| *vs* | *vs* | *vs* | *vs* |
| # of Clusters | # of Clusters | # of Clusters | # of Clusters |

# Viticulture Team
## Plans for 2013

## Objective 2a:

### i. Training systems
- Continue studies
- Converted systems will provide better data

### ii. Canopy management
- Continue studies & include Marquette
- Make wine from treatments (IA)

### iii. Crop level management
- Continue studies as originally planned (IA, NY)
  - Spring frost?
  - Drought conditions?