Viticulture, enology and marketing for cold-hardy grapes

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

Paul Domoto

Iowa State University

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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?

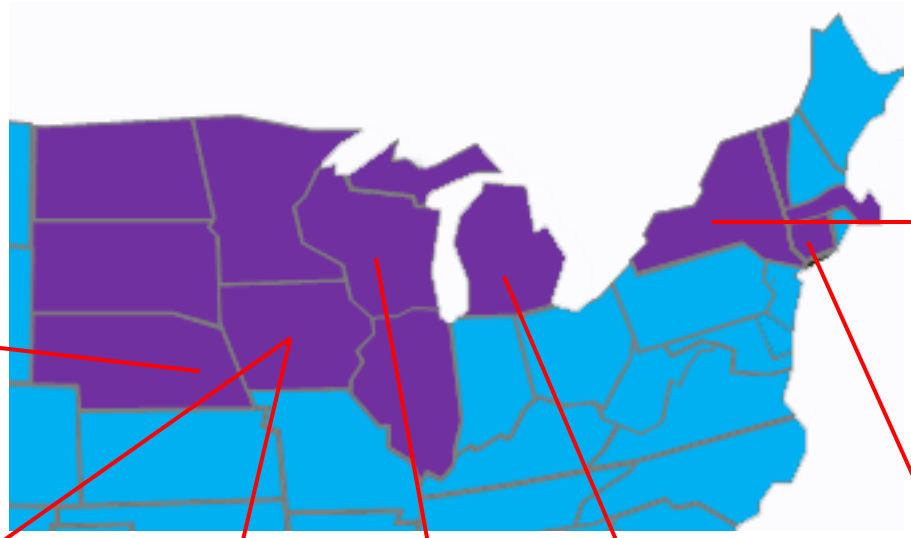
Objective 2

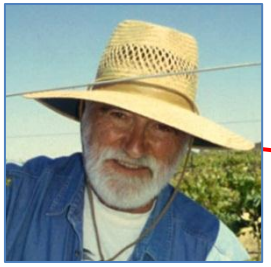
Develop and extend research-based vineyard management practices that allow sustained production of high quality fruit from cold climate cultivars.

- **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

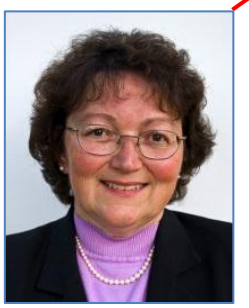




Paul Read

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 Paul Domoto	Paul Read	Paolo Sabatini	Rebecca Harbut
Training systems	HWC (Hudson River Umbrella) MWC/VSP GDC Scott Henry	HWC MWC/VSP Umbrella Kniffin	HWC MWC/VSP GDC Scott Henry	HWC MWC/VSP GDC Smart-Dyson Scott Henry	HWC GDC	?
Cultivars	St. Croix	Frontenac Marquette La Crescent	Frontenac Marquette La Crescent	Frontenac St. Croix	Frontenac Marquette La Crescent St. Croix	Frontenac Marquette 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

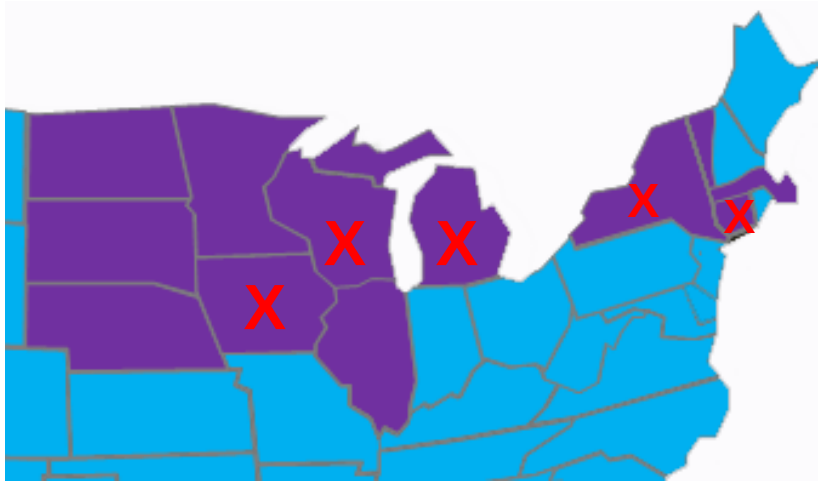
iii. Cropping level management.

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 11 April freeze (20.5 F)				
	50% Bud burst	Shoot Dev.	% Live 1º 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

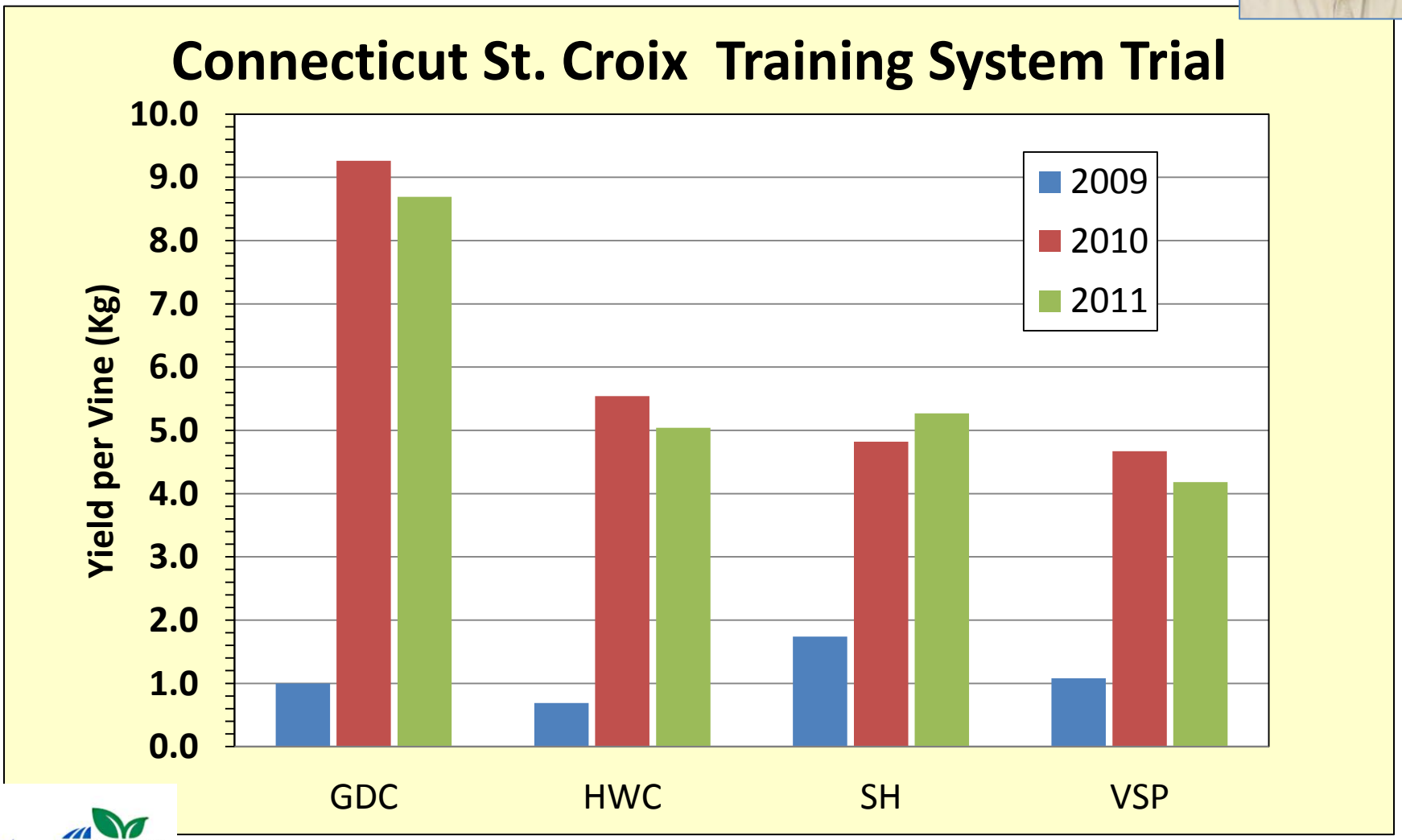
Objective 2a
Outcomes in 2012

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

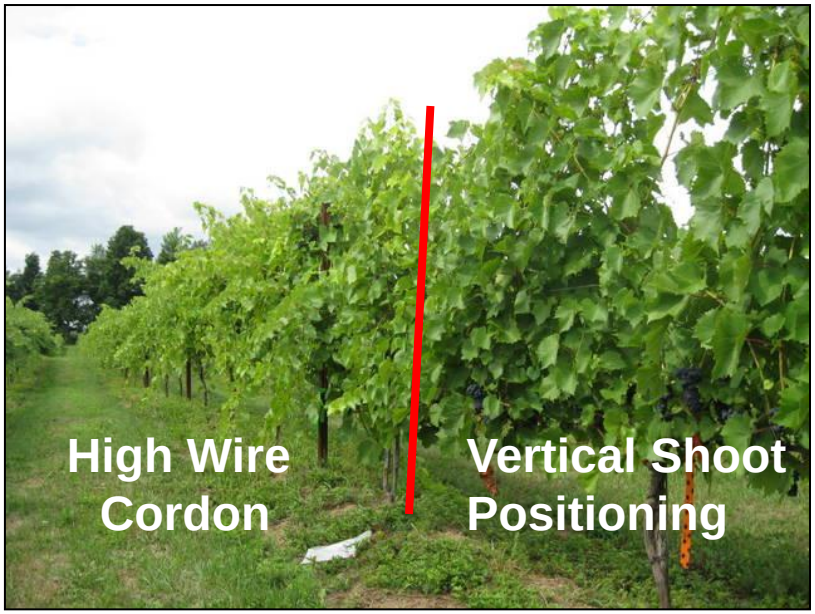
Connecticut:

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

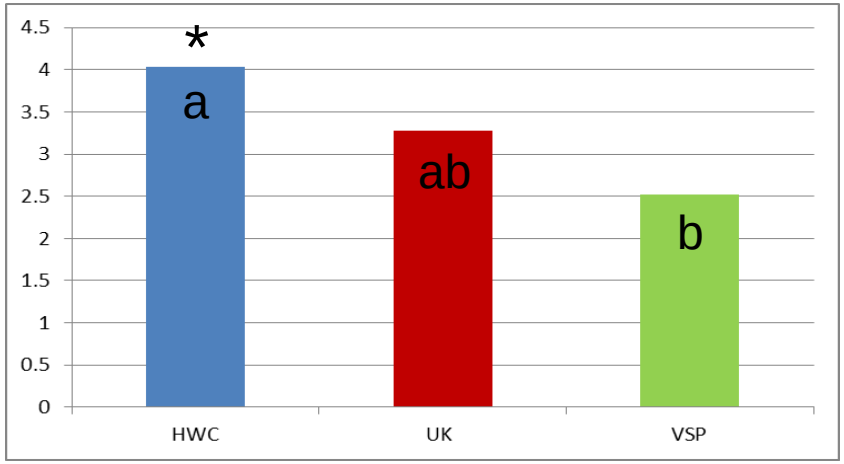
Treatment	Nodes	First shoot	Double/vine	Base buds	Shoots	Shoot/node	% Shootless
High Cordon	23.4	17.7	0.5	1.5	19.6	0.8	25.2%
VSP*	33.6	26.6	0.2	14.7	41.5	1.3	17.9%
Umbrella	29.7	24.0	0.5	1.3	25.9	1.2	0.0%

* Original training system

New York Training Systems

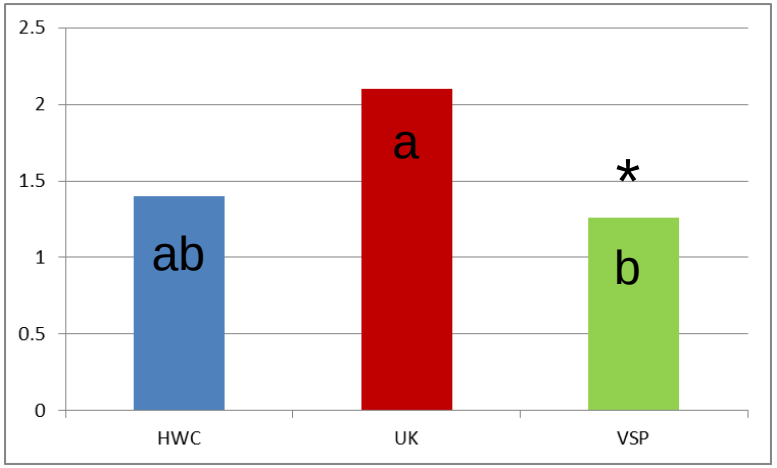
2012 Yield

Frontenac



Tons/Acre

Marquette



Tons/Acre

* Original system

K deficiency
on Frontenac

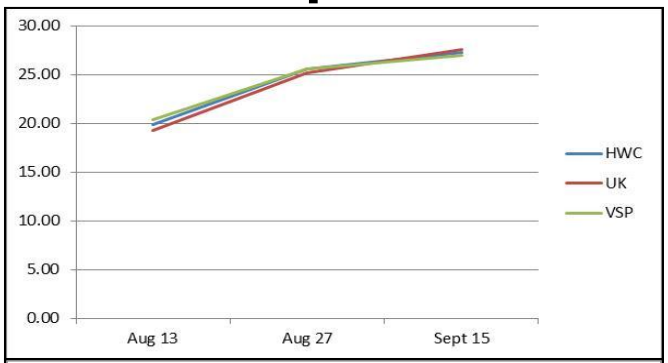
New York Training Systems

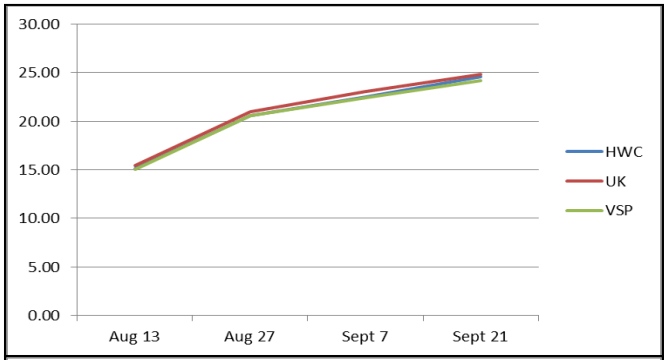
Maturity Indices

Marquette

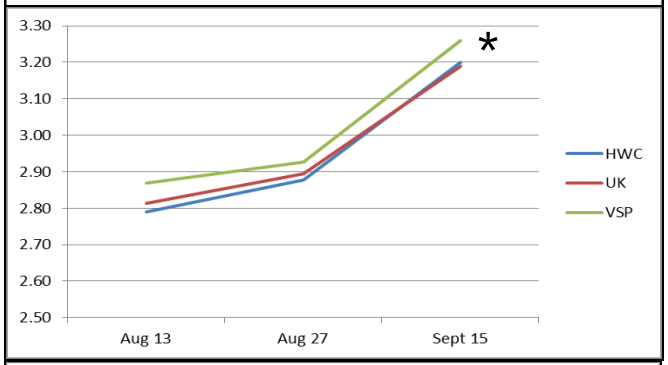
Frontenac

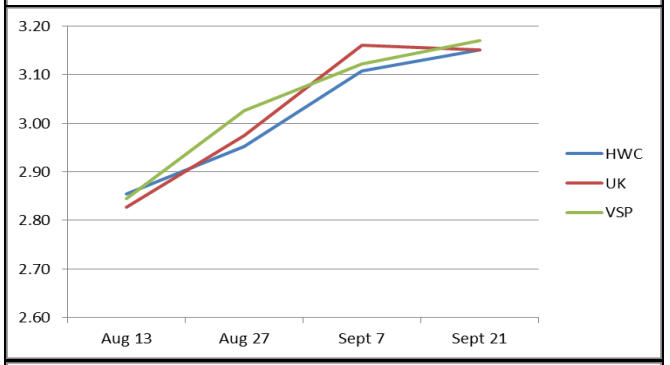
°Brix



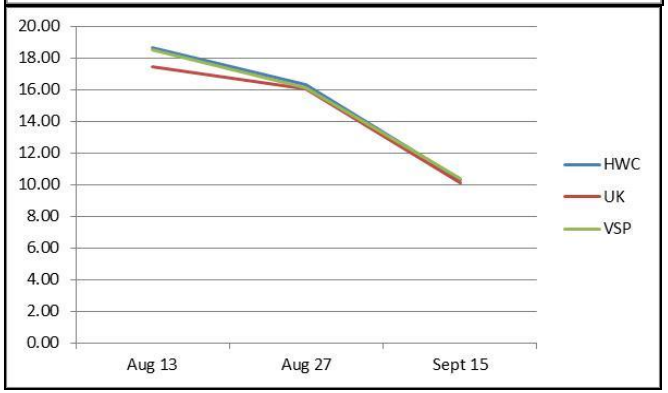


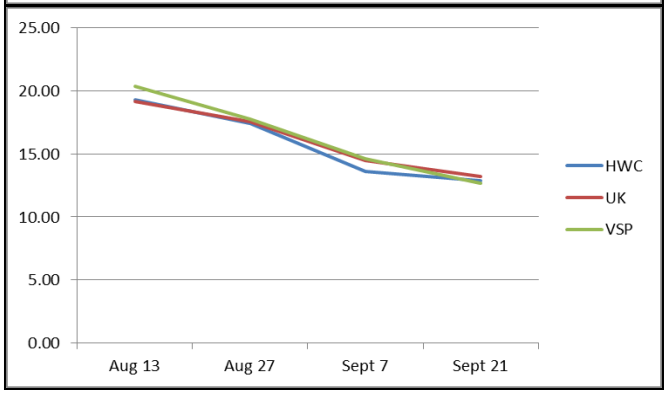
pH



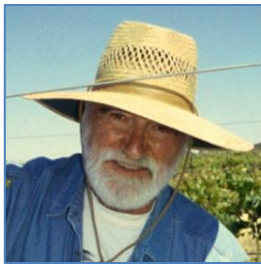


TA





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

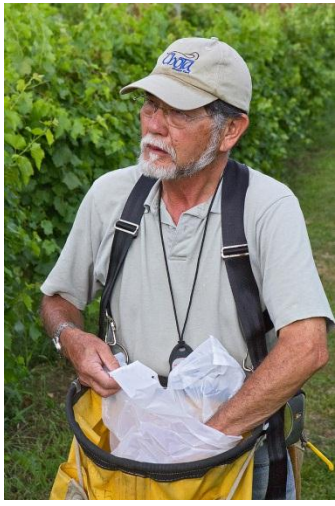
- Conversion year (from HWC)
- Cultivars: Frontenac, La Crescent, Marquette
- Systems: HWC, MWC/VSP, GDC, Scott Henry (or Smart Dyson)?
- Vineyards: Snus Hill, Madrid; Hickory Creek, Adel

Objective 2a

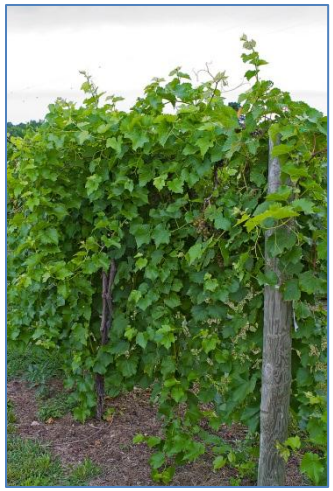
ii Canopy Management

Iowa:

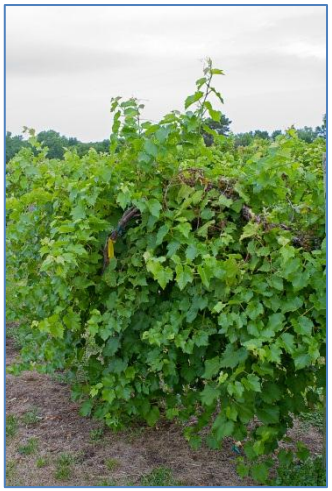
- **Dylan Rolfes**, graduate student, Drs Gail Nonnecke & Paul Domoto
  - Under Grads: Danika Schaaf & Hanna Wallace
- **Cultivars/ Vineyard in 2012:**
  - **Frontenac**: Penoach Vineyards, Adel
  - **La Crescent**: Snus Hill, Madrid
- **Treatments:** all combinations of:
  - Pre-bloom shoot thinning
  - 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



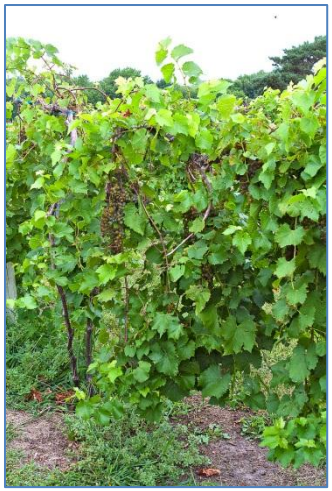
Iowa Canopy Management Treatments



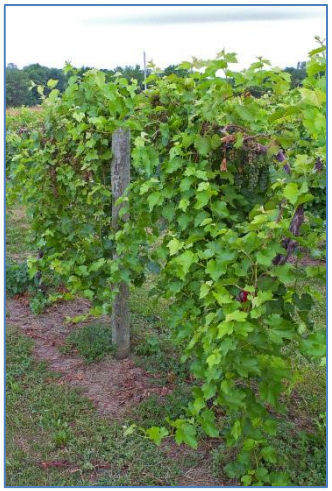
Control



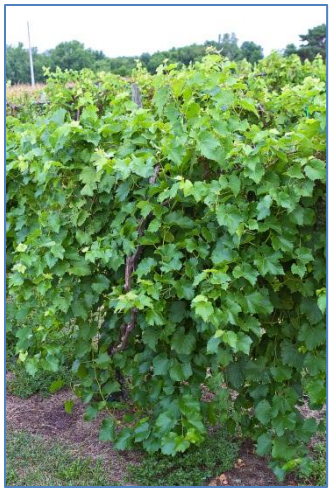
SP



ST

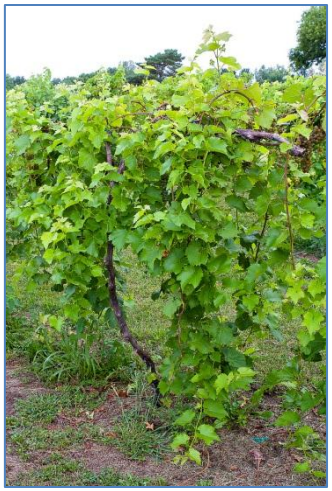


LT



ST + SP

SP + LT

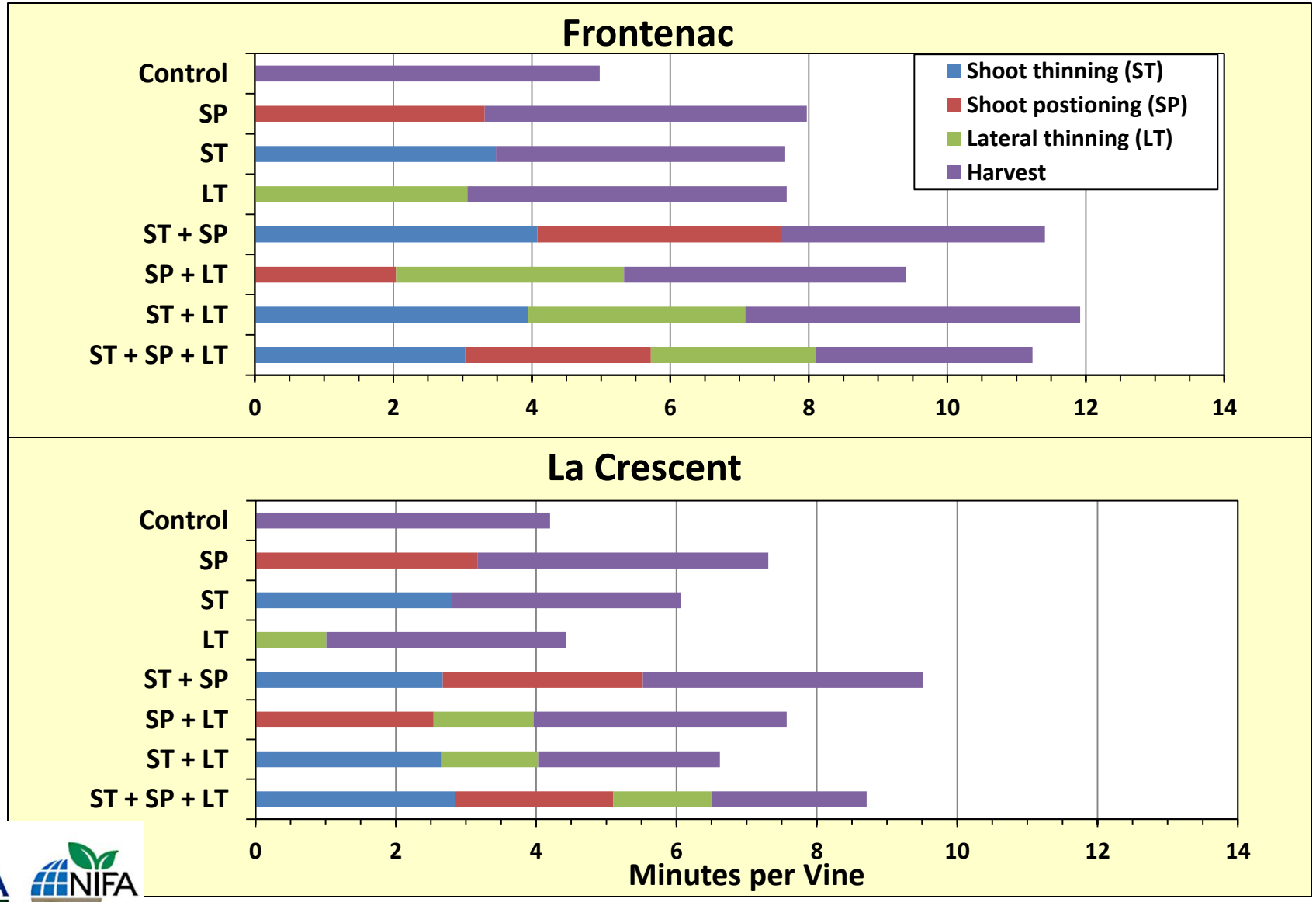


ST + LT

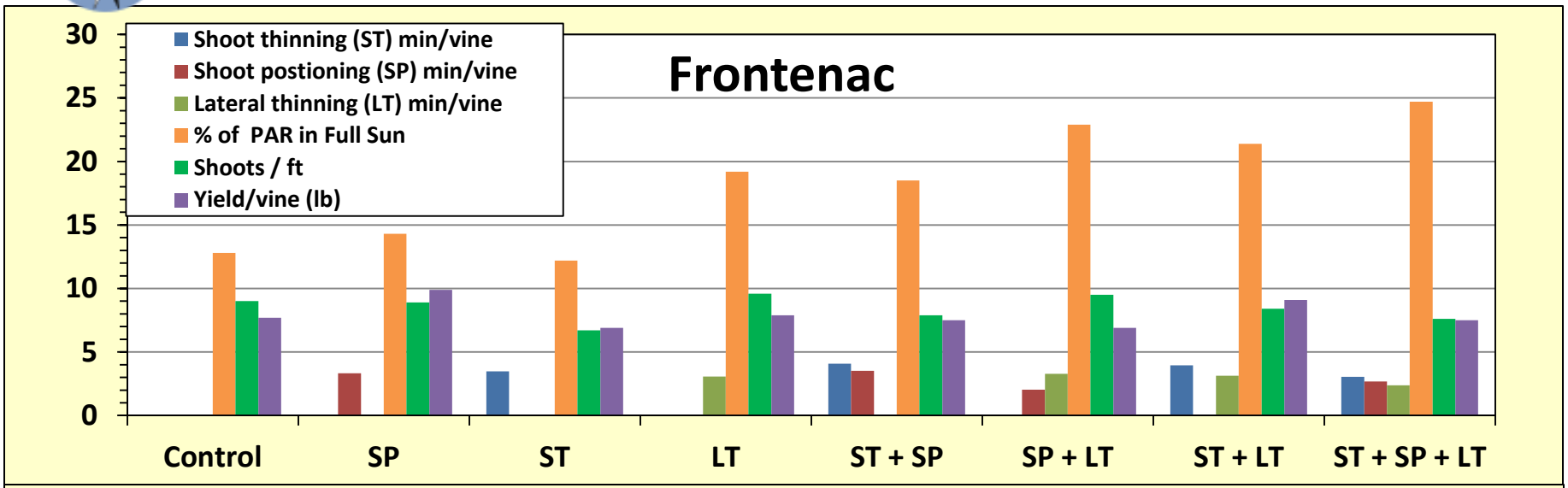
ST + SP + LT

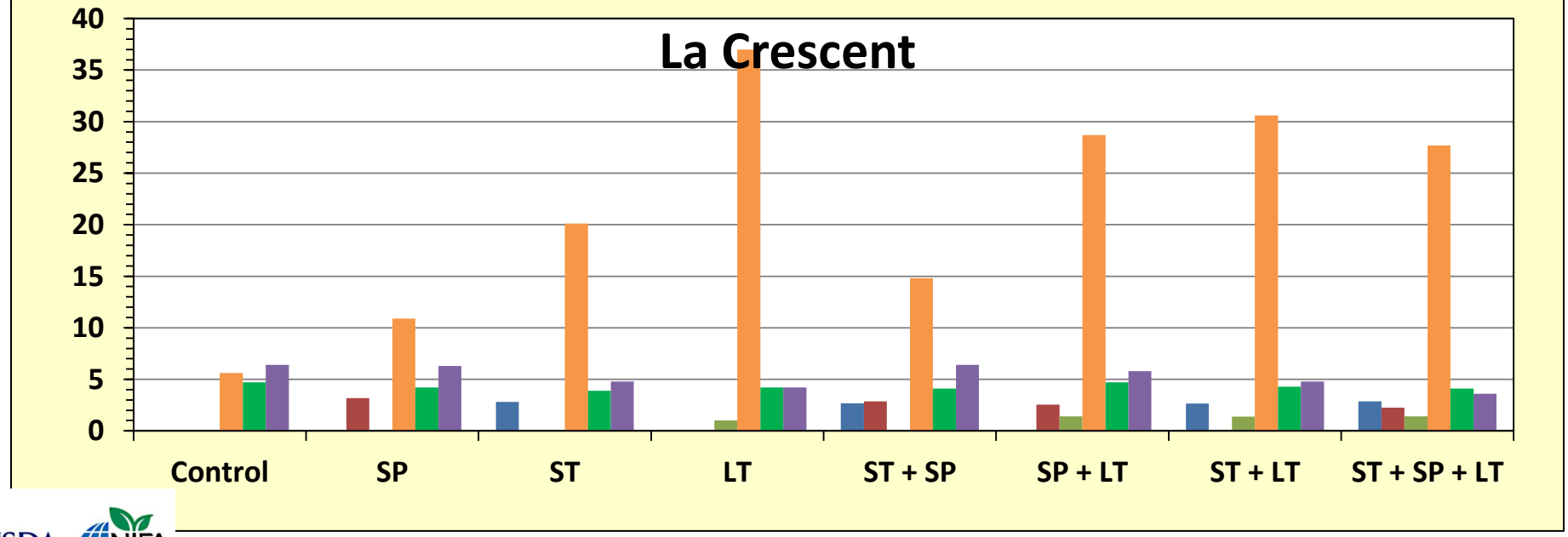
Iowa Canopy Management

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:

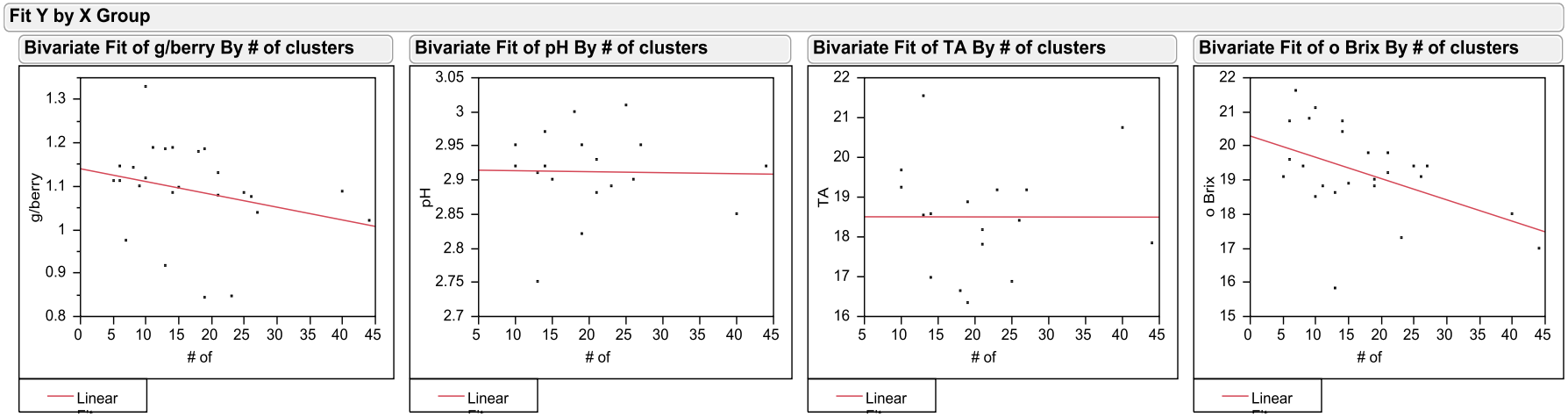
- However:
  - Severe frost/freeze damage in La Crescent prevented study from occurring due to extremely light crop
    - Tagged 25 vines with varying crop, recorded fruit chemistry and yield.
  - Frost/freeze damage in Frontenac meant a somewhat reduced crop, plus very warm weather conditions resulted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