the Southern Region small fruit consortium

Steep Terrain Grape Growing and Grape Canopy Management

June 11-12, 2013, Winchester, Virginia

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Virginia Cooperative Extension

Virginia Tech • Virginia State University

VVA Summer Technical: Steep Terrain Grape Growing | *Tuesday, June 11, 2013*

The Virginia Vineyards Association and Virginia Cooperative Extension are pleased to present the 2013 Summer Technical meeting on "Steep Terrain Grape Growing". The focus will be on the design, installation and management of vineyard sites with slopes that exceed 15%. We are seeing an increasing movement towards steeper sloped vineyards to realize some of the benefits of higher relative elevation. This trend, however, introduces its own set of complications including potentially hazardous operation of machinery, greater potential for soil erosion, and more difficulty with foot traffic and hand labor. The single-day program will be hosted at two premier vineyards: Glen Manor Vineyards (http://glenmanorvineyards.com/), and RdV (http://www.rdvvineyards.com/), both of which feature steep slopes, and both of which produce very high quality wines. The program will include presentations by the host vineyard owners, equipment vendors (e.g., tracked vineyard equipment), and site engineers who will discuss water and soil management on steep slopes.

If you are a person with a disability and desire any assistive devices, services or other accommodations to participate in this activity, please contact Katie Meeks, Virginia Vineyards Association at: VaVineyardsAssoc@gmail.com or 276-728-5905 during business hours of 8:00 AM and 5:00 PM to discuss accommodations five days prior to the event.

Presentation times are approximate; there will be a mix of presentations and field discussions, with refreshment breaks built into the presentation times. ***Wear footwear appropriate for steep terrain and be mindful that we have no control over the weather, other than what we wear...***

7:30 am Registration at Rappahannock Cellars (http://www.rappahannockcellars.com/visit)
Please note: Parking at RdV is extremely limited. We are therefore registering attendees at Rappahannock Cellars and car-pooling to RdV, then Glen Manor, and back to Rappahannock Cellars for the evening social. Cars will depart for RdV at 8:30 am.

9:00 am RdV Vineyards (www.rdvvineyards.com/)
Design considerations for RdV Vineyards, Andrew Camp and Joshua Grainer

11:00 am Depart RdV Vineyards, travel to Glen Manor Vineyards (http://glenmanorvineyards.com/)

12:00 pm Lunch (included with registration)
Sustainable Vineyard Practices Workbook comments, Bill Freitag, VA Vineyards Association

12:30 pm Detailed soils mapping in heterogeneous soils, Alex Blackburn, BCS, LLC

1:00 pm Design considerations for Glen Manor Vineyards, *Jeff White*, Glen Manor Vineyards

1:30 pm Considerations and resources for design of erosion control measures on steep terrain, *Mike Liskey, District Conservationist, Natural Resources Conservation Service*

2:30 pm Vineyard floor management considerations on erodible sites, *Tony Wolf*, Virginia Tech

3:30 pm Machinery safety and steep terrain, *Jimmy Maass*, Virginia Farm Bureau

4:30 pm Meeting recap and audience feedback on meeting, return to Rappahannock Cellars.

5:30 pm Social at Rappahannock Cellars until 8:00 pm

Virginia Sustainable Winegrowers self-Assessment Guide (VSWAG)

Sustainable Viticultural Practices Workbook

Presentation Overview

- What is it?
- WIFM (What's in it for me?)
- Where is it?
- The structure of the guide
- What's in it for the VVA
- Implementation story
- Questions

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What is it?

The Virginia Sustainable Winegrowers self-Assessment Guide (VSWAG) is:

- A compendium of key science-based best management practices (BMPs) for winegrowers in a convenient and easy to use on line tool
- It identifies and promotes winegrowing practices that are:
  - Environmentally sound,
  - Socially equitable, and
  - Economically feasible
- It is not a static repository
  - Will be modified as we learn
  - Will add or delete topics and practices
  - Will add references as needed

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What is it?

- A tool to support the Virginia Vineyards Association's goal of promoting vineyard sustainability with:
  - education
  - communications
  - profitability
- Provides growers with scores calculated using the priority of each practice and the degree of completion assigned by the grower
- Growers can compare themselves against their peers by wine region or statewide.
- Focus educational programs on areas that need improvement
- Moves Virginia into the same league as other major wine growing states that have established grower guidelines

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What's in it for me? (WIFM)

Benefits for growers and wineries:

- For an industry pursuing continuous improvement and competing globally, the VA SWAG will help growers enhance their performance by using all available best practice information.
  - Each practice has information describing the importance of the practice
  - Many practices also have links to more detailed "what to do" info
- Gain recognition as part of a premium wine grape growing and wine production region
- Users will see individual score cards showing their progress. The scores consist of:
  - A priority assigned to each practice, multiplied by
  - The score associated with the degree of satisfaction or completion of each practice
- Users will also get peer group comparisons
- Users will receive a prioritized list of high-priority practices remaining to be completed or enhanced

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Where is it?

- VSWAG is accessible directly from the VVA website under its own Tab labeled Sustainability Guide.

- or bookmark this link and go directly to the site: http://vswag.virginiavineyardsassociation.com
- Let's look inside-

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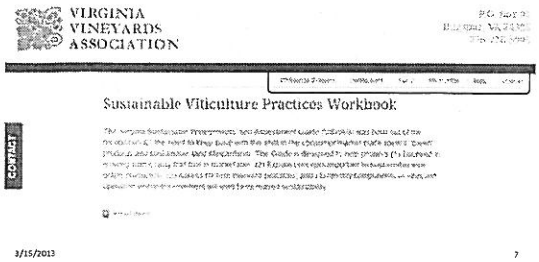
Structure of the guide

- This is the welcome screen after you've logged on. Note the navigation bar at the top and the contact button.



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Structure of the guide

- This is the basic navigation panel to move you through the topics and their practices.
- It also displays what you've accomplished.

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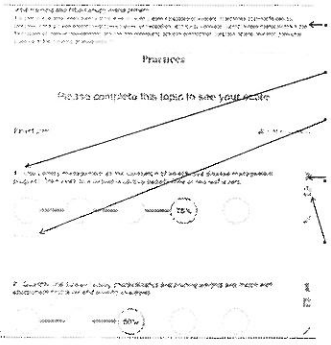
Structure of the guide



- Each section has a TOPIC followed by all the practices in that TOPIC
- Each PRACTICE has a description followed by the scoring mechanism
- There are also related descriptions that explain the importance and purpose of the practice
- There is a mechanism for flagging a practice that displays on the dashboard index
- A note pad that is useful for notes to self for follow up or whatever.

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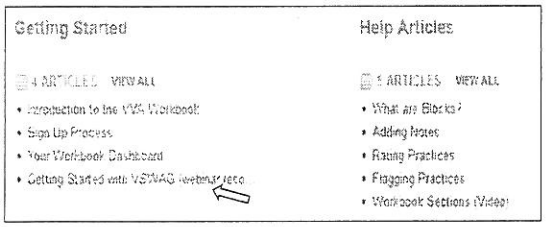
Structure of the guide

- This is the screen for viewing (creating/editing the information about your vineyard blocks.

Structure of the guide

- The VSWAG Support Center contains 'how to' help for various topics
- Of particular note is the video of a webinar (red arrow) that shows you all the steps from sign in to completing all components of the Guide



Expectations for the VVA

- The VVA will administer the website (verifying user eligibili ty, issuing passwords, formatting and running reports).
- The VVA can aggregate scores and percentage-of-completion of each practice by all users, or by categories established by the VVA and required of users as part of the inputs.
- The VVA can track aggregate scores over time, to be used for:
  - Identifying progress or lack thereof in overall and specific management practices.
  - Creating topics for education/promotion via multiple venues to improve state-wide performance.
- Focus educational programs using established mechanisms such as:
  - VVA technical meetings
  - VA Tech research program
  - VCE outreach programs

Implementation Story

• First Work Group Meeting	Jan 2008
• Requirements Provided to AG2	Dec 2012
• Developed the basic database	Jan-Mar 2013
• Launched prototype Workbook	March 2013
• User training started	Mar 2013 (Ongoing)
• Released production Workbook	April 2013
• User workshops	Twice Yearly
• User comments	Always Welcome

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Audience Questions

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Detailed soils mapping for Vineyards in heterogeneous soils

Soil | Foundations

Alex. C. Blackburn, CPSS

Blackburn Consulting Services, LLC.

Have you ever noticed differences within a vineyard block that you can't explain?

Or that make management difficult?

- **High vigor vs low vigor**
- **Needing irrigation vs no irrigation required**
- **Different ripening time**


Soil Foundations
Crop Differences often reflect the underlying Soils
Wouldn't it have been nice to know that before you spent time and money laying out and planting your blocks

Tools for understanding your soils

Soil | Foundations

Web Soil Survey (http://websoilsurvey.nrcs.usda.gov)

- **Soils mapped at 1”=24000’ scale**
- **Mapped for regional purposes**
- **Caution! You can increase the picture you are seeing on the web, but it is still a soil map created at 1”=24000’ scale and inaccuracies in the mapping are also amplified when doing this!**

Site Specific Soil Survey

prepared by a professional soil scientist with mapping experience

- **Prepared at a scale that is appropriate for the property size and intended use (generally 1”=500’ up to 1”=50’)**

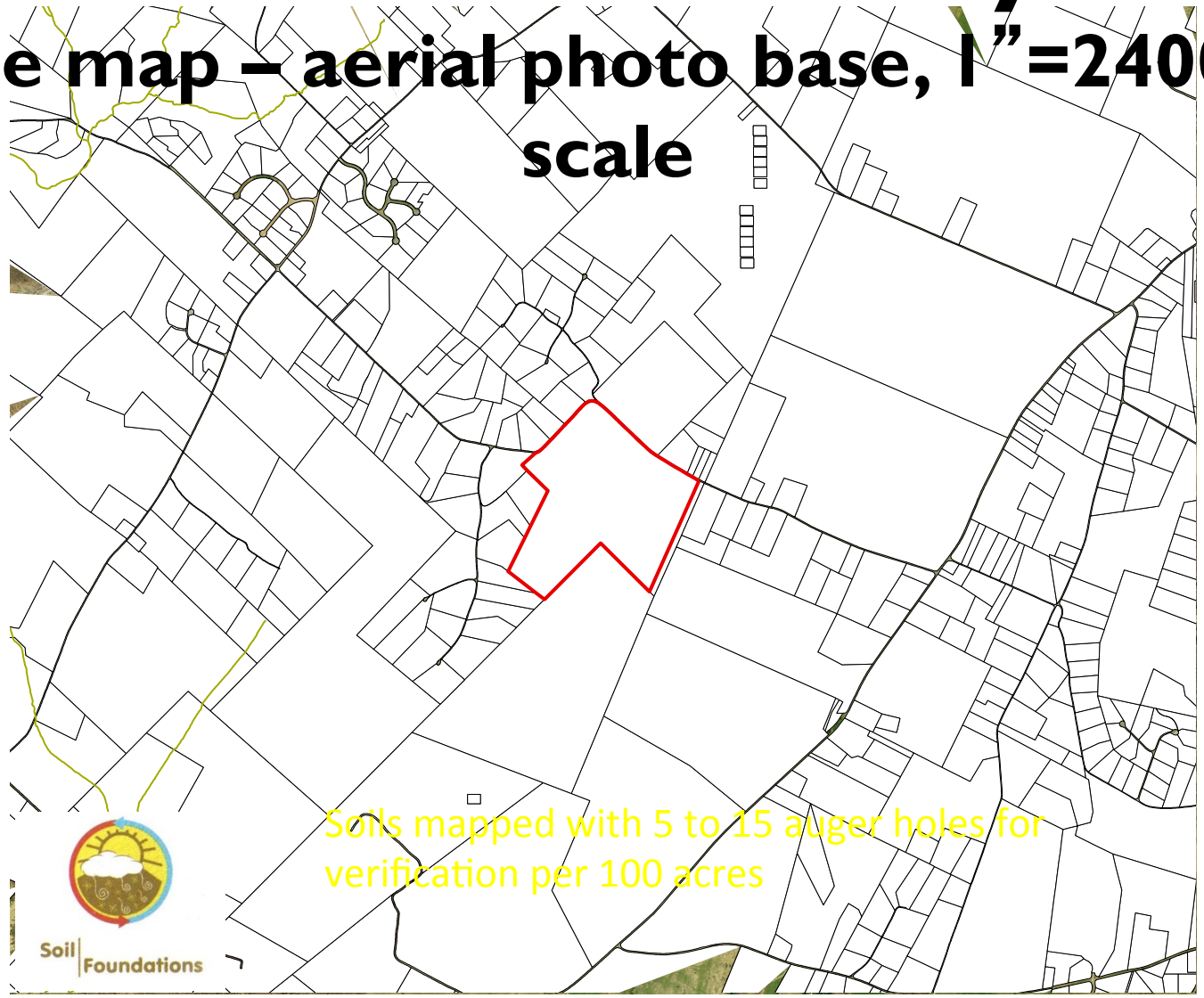
Last year our company mapped the soils at the Winchester Agricultural Research and Extension Center (Tony's research center)

- **We will use this property as an example of differences in the two methods and why those differences exist.**

Soil Foundations

Web Soil Survey

Base map – aerial photo base, 1”=24000’ scale



Soils mapped with 5 to 15 auger holes for verification per 100 acres

Web Soil Survey

Soil Foundations

-Minimum delineation that can be shown is 3-5 acres

-When was the mapping done? Soil survey information on the web started being collected in the 1940's (concepts and the soil classification, even the tools we use to map soils, have changed radically in that time)

-Mapped for general uses and crops (conventional agricultural crops) Not

Site Specific Soil Survey

- Base map- aerial photo base, 1”=500’ to 1”=50’ scale as appropriate for the property and intended use Plus

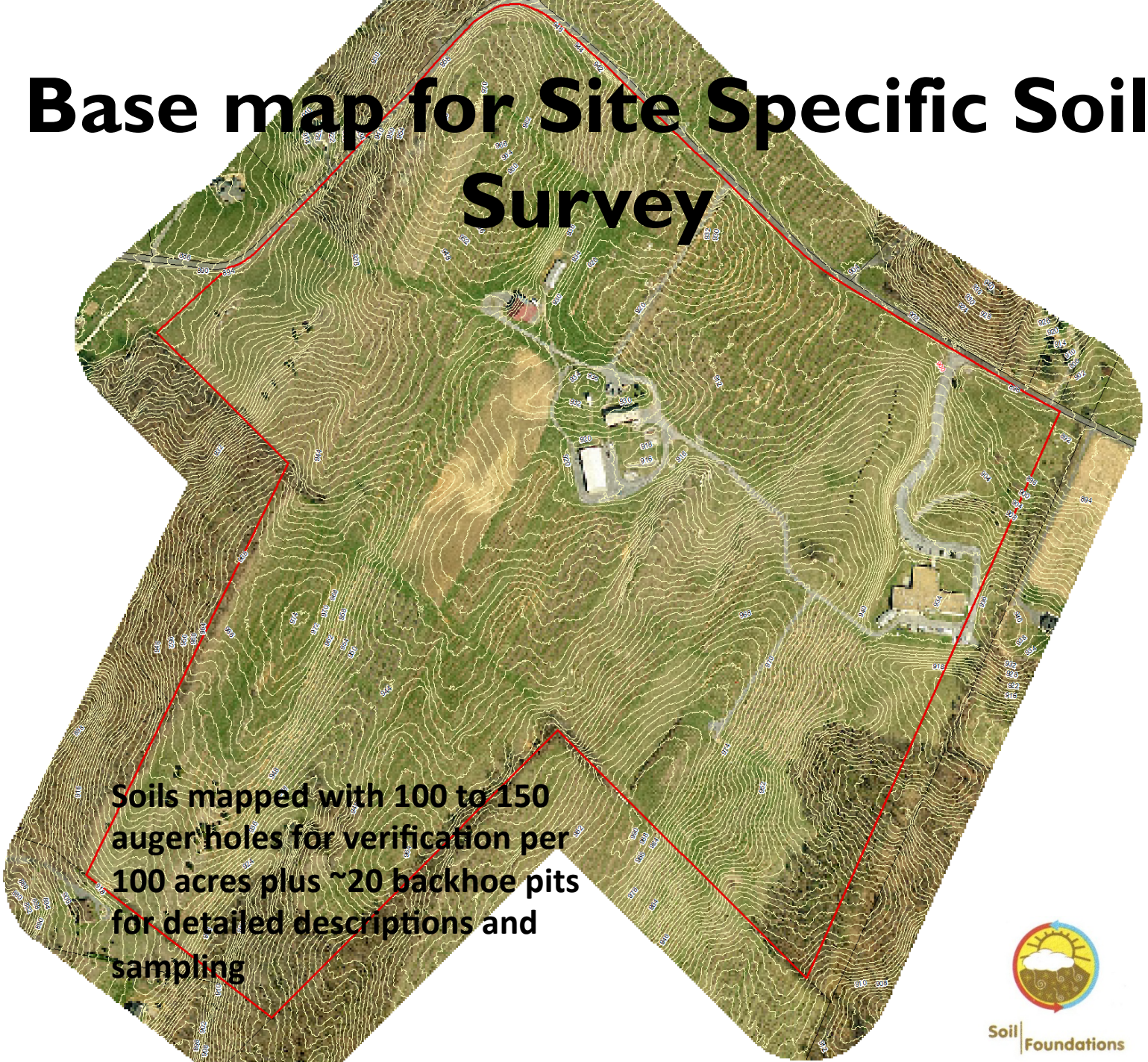
- Contours or topo mapping at 2’ to 5’ intervals for most properties

- Mapped specifically for your intended use or uses!

Base map for Site Specific Soil Survey

Soil Foundations

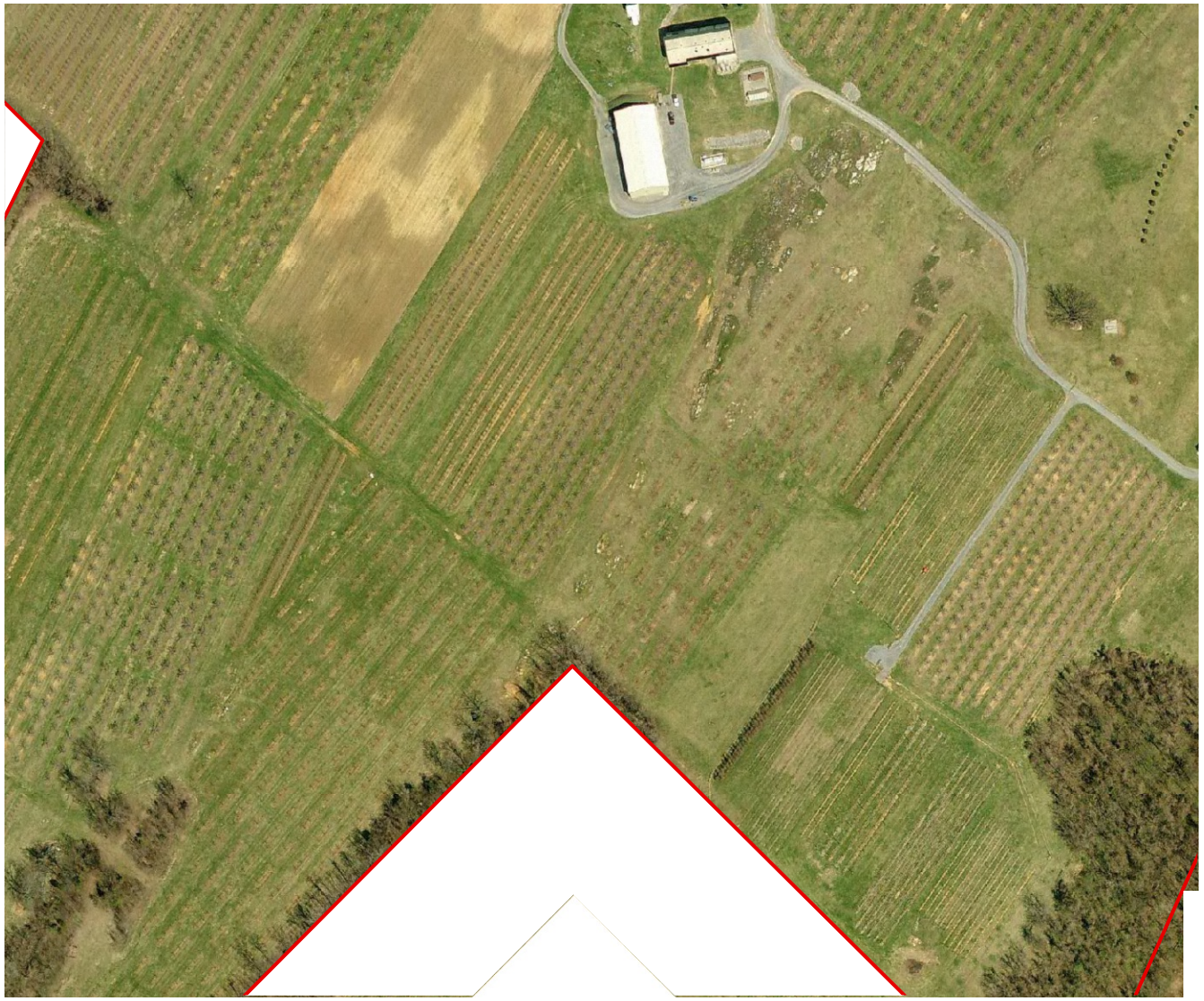
Base map for Site Specific Soil Survey



Soils mapped with 100 to 150 auger holes for verification per 100 acres plus ~20 backhoe pits for detailed descriptions and sampling

Soil Foundations

Base map for Soil Survey



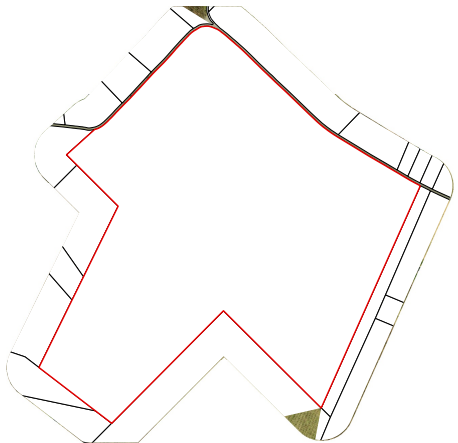
Soil Foundations

Site Specific Focus

Base map for Soil Survey

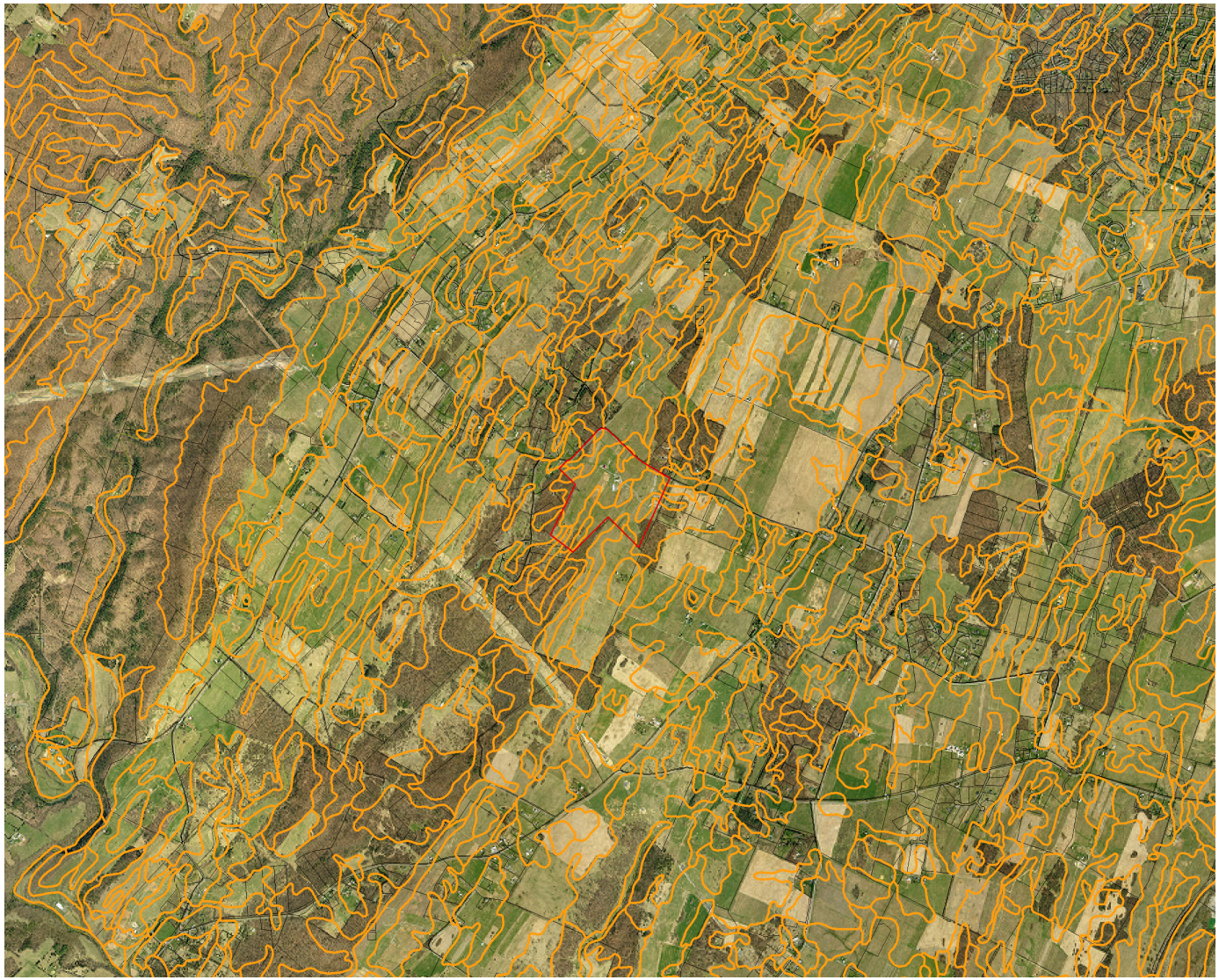
Improved Topographic Data

Size Matters

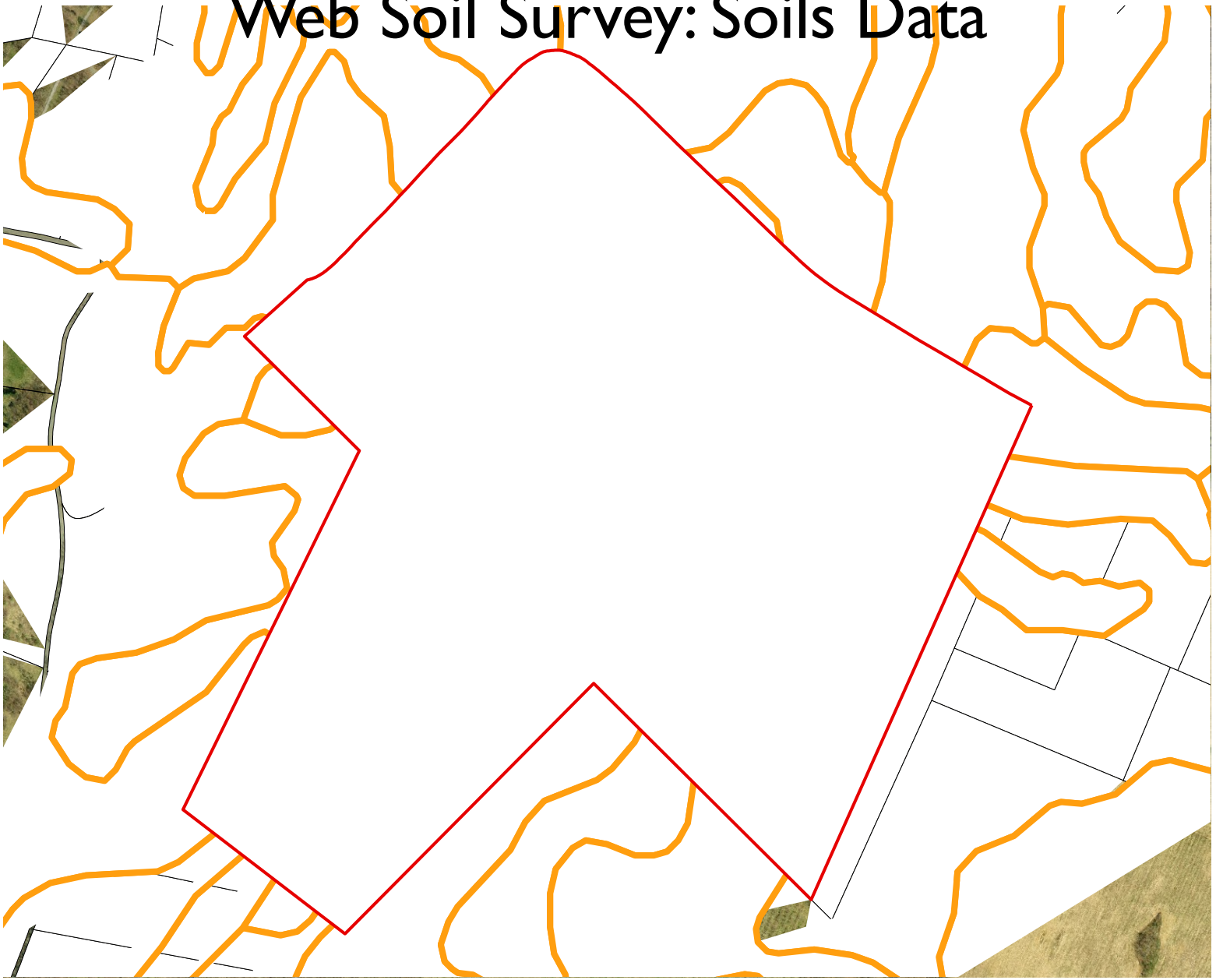


Soil | Foundations

Web Soil Survey: Soils Data



Web Soil Survey: Soils Data



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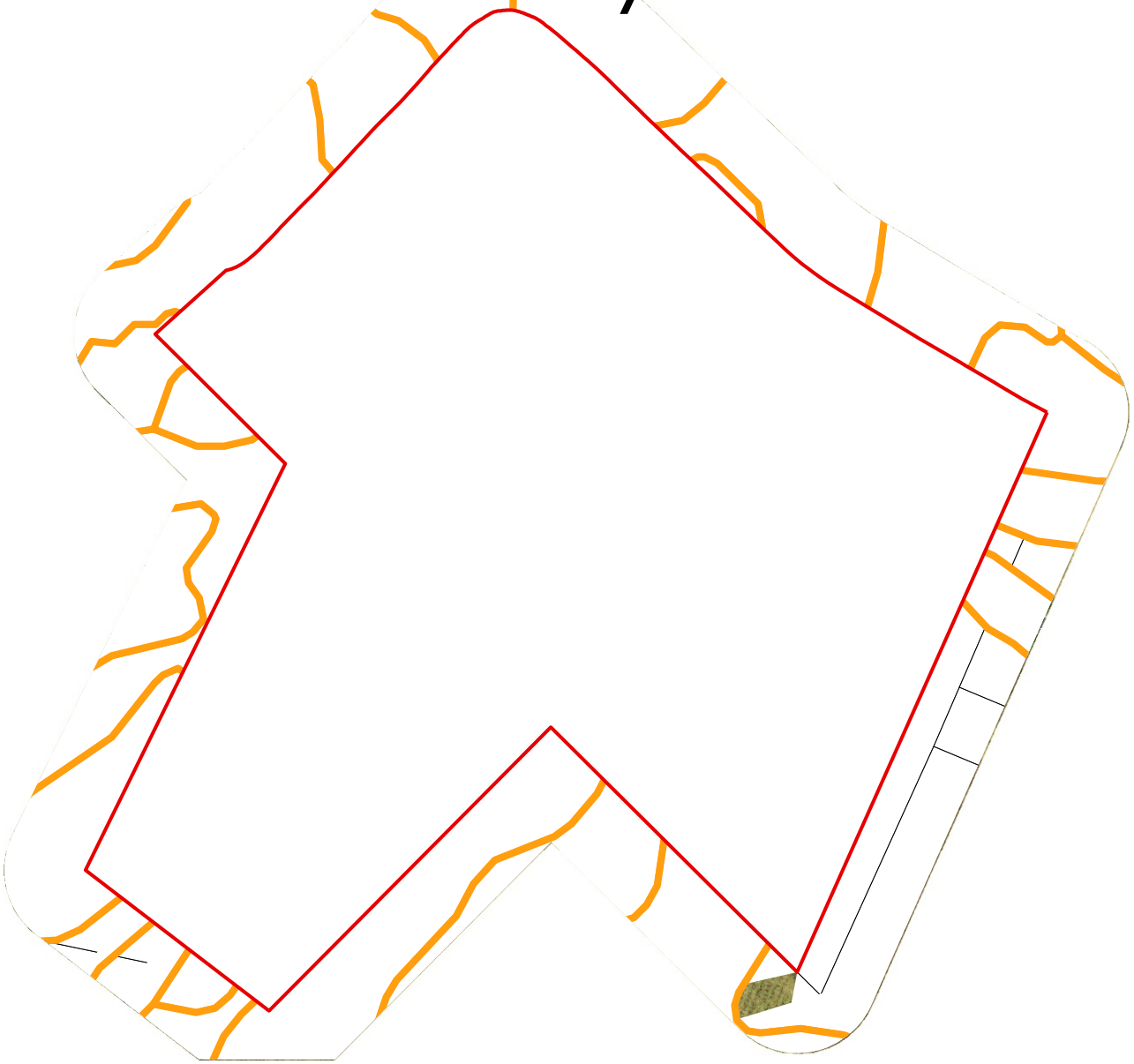
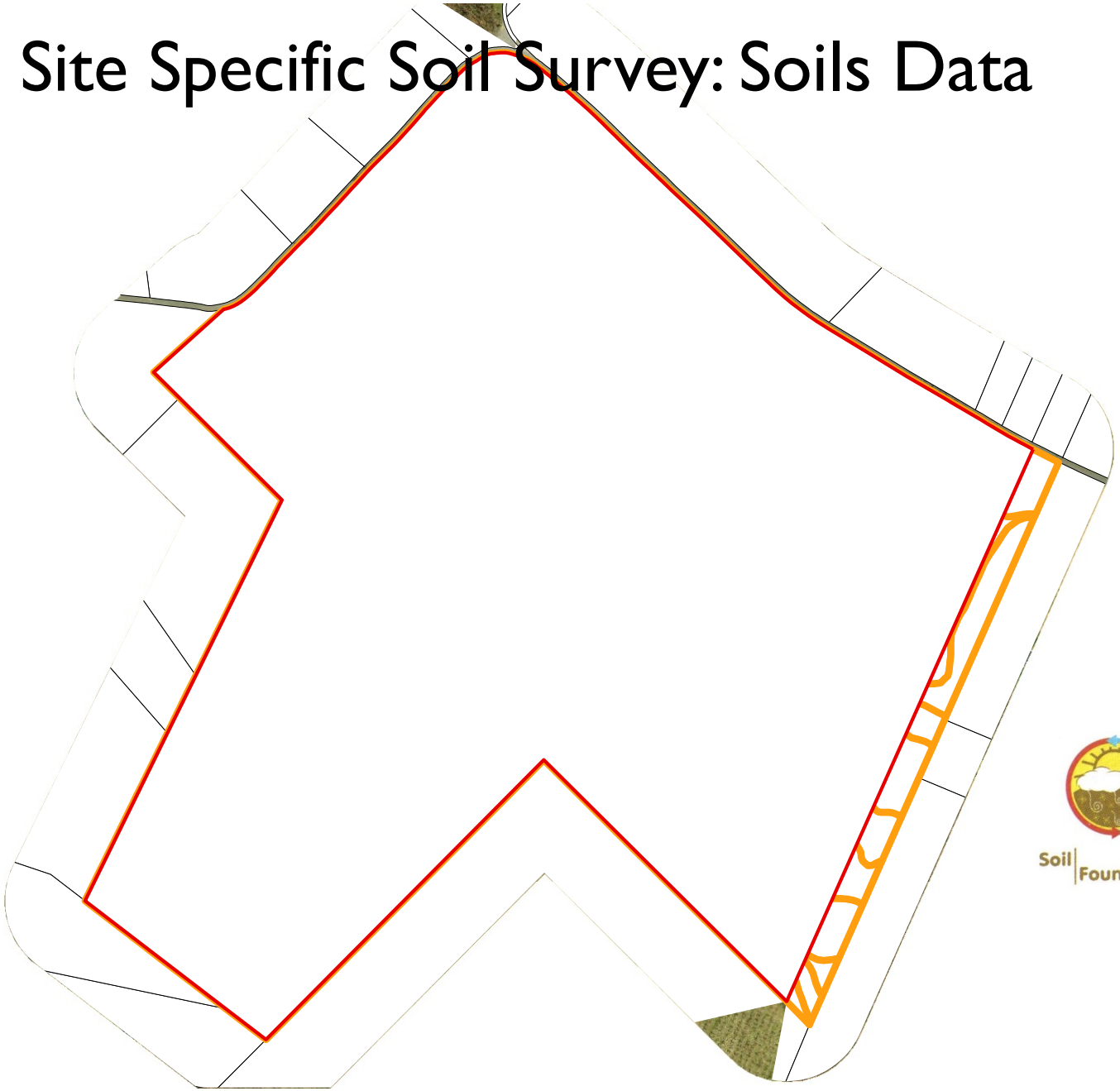
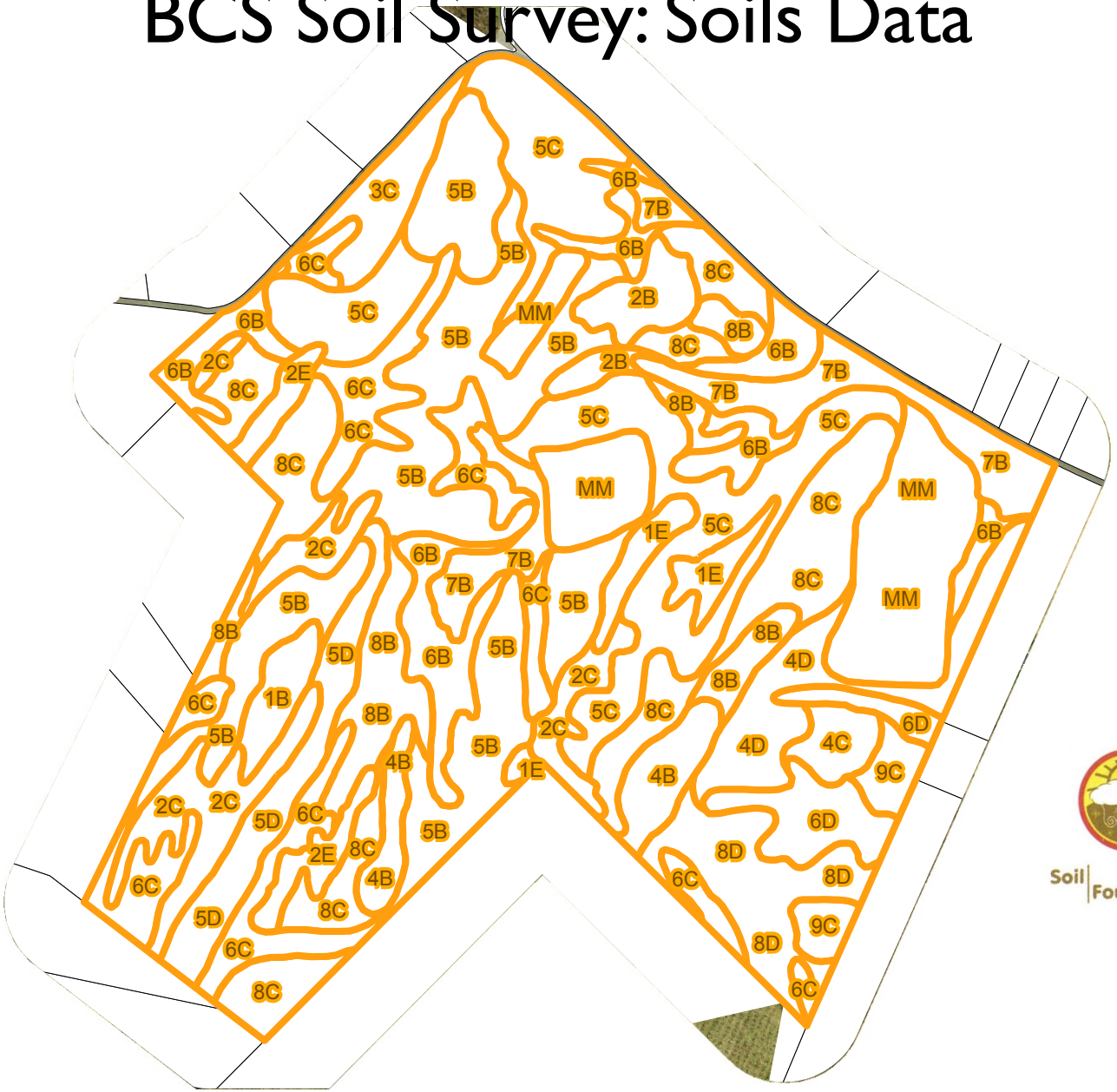


Site Specific Soil Survey: Soils Data



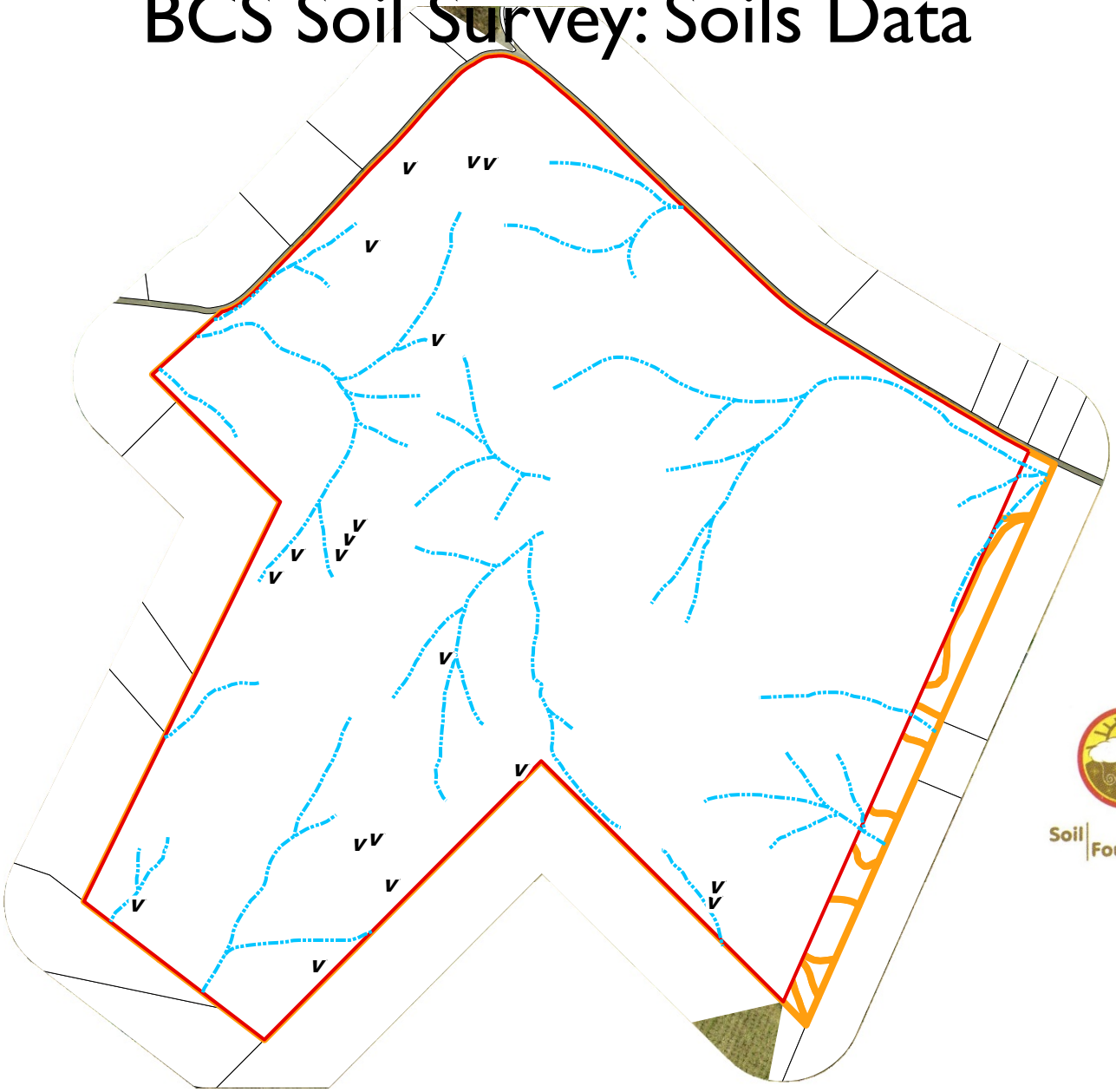
Soil Foundations

BCS Soil Survey: Soils Data



Soil | Foundations

BCS Soil Survey: Soils Data

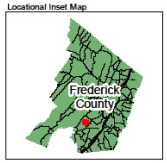


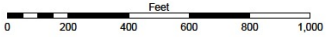
Soil Foundations

Alson H. Smith, Jr.
Agricultural Research and Extension Center

SOILS MAP

Locational Inset Map





Soil Foundations

Blackburn Consulting Services, LLC
Visit us online at:
http://www.soilfoundations.com/

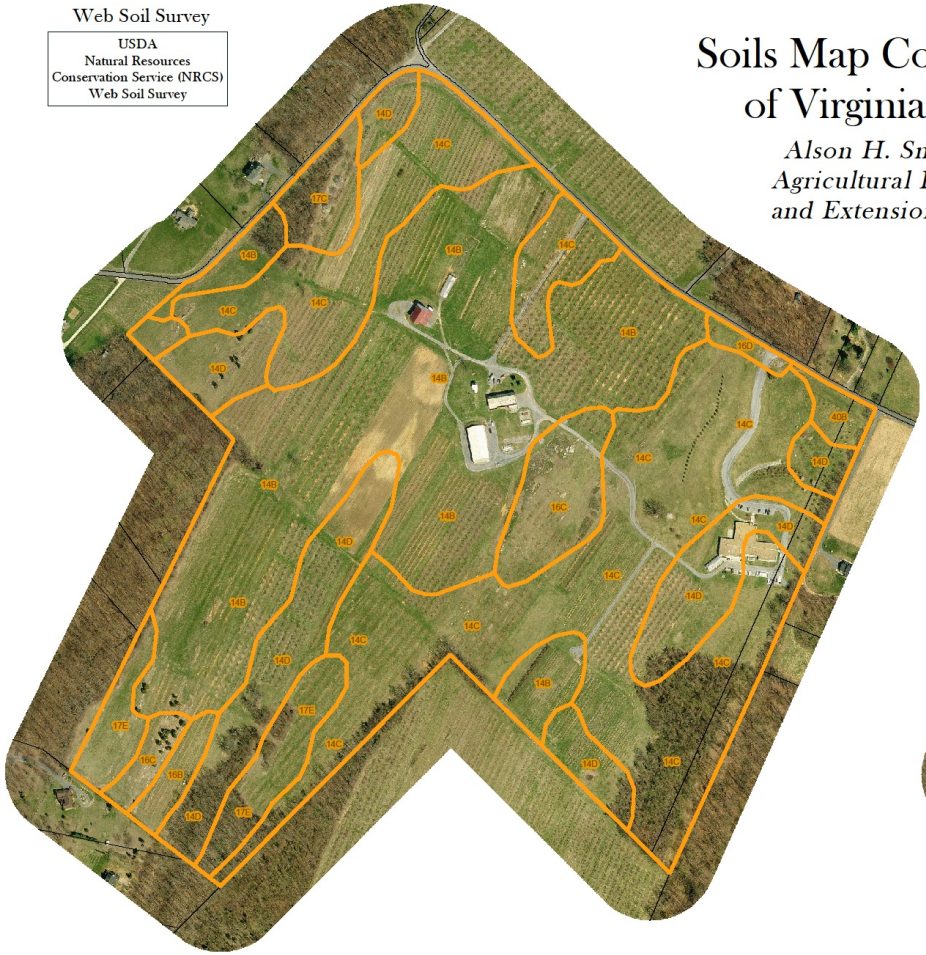
Soil Mapping Legend		
1B	Opequon - Rock Outcrop	> 25 % slopes
2C	Hagerstown - Rock Outcrop	7 - 15 % slopes
2E	Hagerstown - Rock Outcrop	> 25 % slopes
3C	Hagerstown silty clay loam	7 - 15 % slopes
4B	Lodi - Poplimento complex	2 - 7 % slopes
4C	Lodi - Poplimento complex	7 - 15 % slopes
4D	Lodi - Poplimento complex	15 - 25 % slopes
5B	Poplimento Silt Loam	2 - 7 % slopes
5C	Poplimento Silt Loam	7 - 15 % slopes
5D	Poplimento Silt Loam	15 - 25 % slopes
6B	Marbie - Wyrick complex, gravelly	2 - 7 % slopes
6C	Marbie - Wyrick complex, gravelly	7 - 15 % slopes
7B	Timberville silt loam	2 - 7 % slopes
8B	Poplimento - Hagerstown Complex	2 - 7 % slopes
8C	Poplimento - Hagerstown Complex	7 - 15 % slopes
8D	Poplimento - Hagerstown Complex	15 - 25 % slopes
9C	Braddock Cobbly loam	7 - 15 % slopes
MM	Man made (disturbed land)	

Soils Map Comparison of Virginia Tech's

Alson H. Smith, Jr. Agricultural Research and Extension Center

Web Soil Survey

USDA
Natural Resources
Conservation Service (NRCS)
Web Soil Survey



DetailedSoil Survey

Blackburn Consulting
Services, LLC / Soil Foundations
Soil Survey

Field Work and Map Provided By:

Soil Foundations

Blackburn Consulting Services, LLC
Visit us online at:
http://www.soilfoundations.com/

Soil Mapping Legend		
17E	Frederick-Poplimento-Rock Outcrop Complex	15 - 45 % slopes
17C	Frederick-Poplimento-Rock Outcrop Complex	2 - 15 % slopes
14D	Frederick-Poplimento Loams	15 - 25 % slopes
14B	Frederick-Poplimento Loams	2 - 7 % slopes
14C	Frederick-Poplimento Loams	7 - 15 % slopes
16D	Frederick-Poplimento Loams, Very Rocky	15 - 25 % slopes
16B	Frederick-Poplimento Loams, Very Rocky	2 - 7 % slopes
16C	Frederick-Poplimento Loams, Very Rocky	7 - 15 % slopes
40B	Timberville Silt Loam	2 - 7 % slopes

Narrative:

Web Soil Survey on the LEFT

Site Specific Soil Survey prepared by Blackburn Consulting Services, LLC / Soil Foundations on the RIGHT

** Note not only the differences in the maps but also the mapping legends for each

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8D	Poplimento - Hagerstown Complex	15 - 25 % slopes
9C	Braddock Cobbly loam	7 - 15 % slopes
MM	Man made (disturbed land)	

Rock Outcrops
Soil Drains
Soil Mapping Units

N
W E
S

0 200 400 600 Feet

Web Soil Survey

Soil Mapping Legend		
17E	Frederick-Poplimento-Rock Outcrop Complex	15 - 45 % slopes
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Soil | Foundations

BCS, LLC Detailed Soil Survey

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9C	Braddock Cobbly loam	7 - 15 % slopes
MM	Man made (disturbed land)	

Where to look for good vineyard sites

1- **Slope- this, of course, will vary depending on where you live**

Slope helps to get unwanted water away from your site

2-Agricultural fields? Usually cleared for conventional crops (good corn land = vigor)

3-Wooded or partially wooded areas?
Farmers are pretty good soil scientists!
don't overlook their clues!

Soil | Foundations

Clearing and Grading

-Clearing must be done with TLC
(1” vs 6” of topsoil)

-Use of the proper equipment
(Track hoe w/thumb)

-Weather and soil conditions must be right

-Immediate stabilization

Soil | Foundations

In Virginia, Erosion and Sedimentation law exempts clearing for agricultural fields/crops.

However,

If you are going to clear land we always suggest getting a E&S Plan prepared for your project and notifying your State, County and Federal agencies of your proposed activities.

-This will insure oversight of the clearing,
-Avoid the loss of soil/topsoil and
-Avoid complaints leading to STOP WORK orders and idol machinery

Soil Foundations

Glen Manor
2244 Browntown Road
Front Royal, Virginia 22630
(540) 635-6324

FARM HISTORY

- PURCHASED IN 1901
- SUBSISTENCE FARM, THEN PRIMARILY CATTLE
- LOWER VINEYARDS ESTABLISHED IN 1995
- FOREST CLEARED IN 2006
- WINERY CONSTRUCTED IN 2007, TASTING ROOM OPENED IN 2008
- UPPER VINEYARDS ESTABLISHED IN 2008
- ONLY ESTATE FRUIT USED FOR GMV WINES

STEEP TERRAIN VINEYARD DESIGN AND CONSTRUCTION TIMELINE

CONSULTANTS – ALEX BLACKBURN, MIKE LISKEY AND MYSELF (12 YEARS IN INDUSTRY IN 2005)

SITE HISTORY

- ANCESTORS ATTEMPTED CULTIVATION IN EARLY 1900'S
- ATTEMPT AND LAND SOON ABANDONED
- TRANSITIONAL FOREST SINCE CHILDHOOD, OPEN → VIRGINIA PINES → SOFTWOODS →YOUNG HARDWOODS
- ONCE IN INDUSTRY, SAW VINEYARD POTENTIAL

DEVELOPMENT TIMELINE

- FOR INITIAL SOIL EVALUATION, WALKED SITE WITH ALEX BLACKBURN, LATE 2005
- MET WITH MIKE LISKEY, EARLY 2006
    - **FARM MANAGEMENT PLAN** - TO CONTROL EROSION DURING AND AFTER FOREST CLEARING
        - CHECK DAMS, SEDIMENT CONTROL PONDS, BROWNTOP MILLET, GRASS BLENDS
- HIRED EXPERIENCED LOGGER/EXCAVATOR – HAD COMPLETED **RdV** PROJECT PRIOR

  CONTRACT:
    - AFTER RAINS, NO WORK UNTIL I SAY SO – SOIL COMPACTION ISSUE
    - BURN PITS WHERE I SAY SO – ONLY WHERE I'LL NOT PLANT
    - PAY BY THE ACRE NOT BY THE HOUR – FIRM SCHEDULE
- AFTER LAND CLEARED
    - TRACTOR RAKED AND HAND PICKED UP LOTS OF SMALL STICKS AND ROCKS
    - LIME AND FERTILIZER APPLIED AND DISC UNDER
    - SEEDED WITH BROWNTOP MILLET – GERMINATES FAST, EVEN IN HOT WEATHER AND DRY SOIL
    - OVER SEEDED WITH GRASS BLEND, CREEPING RED FESCUE, SHEEP AND BENT GRASS, IN EARLY FALL
    - HIRED ALEX BLACKBURN – **SOILS SURVEY AND MAP**

VINEYARD INSTALLATION

- DEER FENCE CONSTRUCTED WINTER 2006-2007
- LOCAL SURVEYOR STAKED OUT FIRST 4 ACRES IN SUMMER OF 2007
- ROWS HERBICIDED AND RIPPED LATE SUMMER 2007
- POSTS, ANCHORS AND FRUITING WIRE INSTALLED WINTER 2007-2008
- **PLANTED MARCH 2008**
- BAMBOO AND FOLIAGE WIRES INSTALLED SPRING 2008
- LOCAL SURVEYOR STAKED OUT ADDITIONAL 4.5 ACRES IN SUMMER OF 2008
- ROWS HERBICIDED AND RIPPED LATE SUMMER 2008
- POSTS, ANCHORS AND FRUITING WIRE INSTALLED WINTER 2008-2009
- **PLANTED MARCH 2009**
- BAMBOO AND FOLIAGE WIRES INSTALLED SPRING 2009
- CHECK DAMS REMOVED SUMMER OF 2009 – SEDIMENT CONTROL PONDS TO REMAIN INDEFINITELY

MACHINERY

- CRAWLER TRACK TRACTOR – 1.5 MPH VS. 2 WHEEL DRIVE RUBBER TIRE TRACTOR – 3.5 MPH
- LOW VOLUME 3-POINT HITCH SPRAYER
- 3-POINT HITCH BUSHHOG
- WEED WHACKERS
- 2 HARVEST TRAILERS – 8' FOR ROW PICKUP & 16' FOR WINERY TRANSPORTATION

LABOR

- 5 FULL TIMERS, INCLUDING ME, FOR 14.5 ACRES VINES INCLUDING 226 ACRE FARM
- STEEP VINEYARD REQUIRES TWICE AS MUCH LABOR TIME - FATIGUE FACTOR

WATER

- REMOTE LOCATION WITHOUT ELECTRICITY
- INSTALLED SOLAR WELL PUMP USED OUT WEST ON LARGE CATTLE RANCHES
- SOLAR PUMPED WATER INTO TWO 1500 GALLON UNDERGROUND CONCRETE TANKS
- GRAVITY DOWN TO PESTICIDE BUILDING

WHAT HAS WORKED

- SMALLER VINES, SMALLER BERRIES AND MORE OPEN CANOPY THAN ORIGINAL VINEYARD
- SOILS DRY OUT FAST AFTER RAINS
- VINES STOP SHOOT AND LEAF GROWTH AT VERAISON
- FRUIT AND RESULTING WINE OF HIGHER QUALITY THAN ORIGINAL VINEYARD

WHAT PROBLEMS HAVE OCCURRED

- LARGE SURFACE ROCKS IN SOME ROWS – THOSE ROWS FLAGGED FOR DOWN HILL TRAFFIC ONLY
- EROSION ON STEEP HEADLANDS WHERE CRAWLER TURNS AROUND
- HARVESTING FRUIT – DOWN HILL ONLY

THINGS TO DO DIFFERENT

- TRAFFIC RESISTANT GRASS/OTHER PLANT TYPE IN HEADLANDS
- TURN-A-ROUNDS ON LESS STEEP TERRAIN (IF POSSIBLE)

FUTURE PLANS

- LOGGING AND CLEARING MORE STEEP TERRAIN THIS SUMMER
- TWO ADDITIONAL RIDGES IN 5 TO 10 YEARS

Thank you, and if you're interested:

- Three 100+ ACRE HIGH POTENTIAL STEEP TERRAIN VINEYARD SITES FOR SALE IN THIS VALLEY

FAX (540) 631-3064 • Web Address: www.glenmanorvineyards.com • Email: gmvwine@glenmanorvineyards.com

Glen Manor
2244 Browntown Road
Front Royal, Virginia 22630
(540) 635-6324

FARM HISTORY

- PURCHASED IN 1901
- SUBSISTENCE FARM, THEN PRIMARILY CATTLE
- LOWER VINEYARDS ESTABLISHED IN 1995
- FOREST CLEARED IN 2006
- WINERY CONSTRUCTED IN 2007, TASTING ROOM OPENED IN 2008
- UPPER VINEYARDS ESTABLISHED IN 2008
- ONLY ESTATE FRUIT USED FOR GMV WINES

STEEP TERRAIN VINEYARD DESIGN AND CONSTRUCTION TIMELINE

CONSULTANTS – ALEX BLACKBURN, MIKE LISKEY AND MYSELF (12 YEARS IN INDUSTRY IN 2005)

SITE HISTORY

- ANCESTORS ATTEMPTED CULTIVATION IN EARLY 1900'S
- ATTEMPT AND LAND SOON ABANDONED
- TRANSITIONAL FOREST SINCE CHILDHOOD, OPEN → VIRGINIA PINES → SOFTWOODS →YOUNG HARDWOODS
- ONCE IN INDUSTRY, SAW VINEYARD POTENTIAL

DEVELOPMENT TIMELINE

- FOR INITIAL SOIL EVALUATION, WALKED SITE WITH ALEX BLACKBURN, LATE 2005
- MET WITH MIKE LISKEY, EARLY 2006
    - **FARM MANAGEMENT PLAN** - TO CONTROL EROSION DURING AND AFTER FOREST CLEARING
        - CHECK DAMS, SEDIMENT CONTROL PONDS, BROWNTOP MILLET, GRASS BLENDS
- HIRED EXPERIENCED LOGGER/EXCAVATOR – HAD COMPLETED **RdV** PROJECT PRIOR

  CONTRACT:
    - AFTER RAINS, NO WORK UNTIL I SAY SO – SOIL COMPACTION ISSUE
    - BURN PITS WHERE I SAY SO – ONLY WHERE I'LL NOT PLANT
    - PAY BY THE ACRE NOT BY THE HOUR – FIRM SCHEDULE
- AFTER LAND CLEARED
    - TRACTOR RAKED AND HAND PICKED UP LOTS OF SMALL STICKS AND ROCKS
    - LIME AND FERTILIZER APPLIED AND DISC UNDER
    - SEEDED WITH BROWNTOP MILLET – GERMINATES FAST, EVEN IN HOT WEATHER AND DRY SOIL
    - OVER SEEDED WITH GRASS BLEND, CREEPING RED FESCUE, SHEEP AND BENT GRASS, IN EARLY FALL
    - HIRED ALEX BLACKBURN – **SOILS SURVEY AND MAP**

VINEYARD INSTALLATION

- DEER FENCE CONSTRUCTED WINTER 2006-2007
- LOCAL SURVEYOR STAKED OUT FIRST 4 ACRES IN SUMMER OF 2007
- ROWS HERBICIDED AND RIPPED LATE SUMMER 2007
- POSTS, ANCHORS AND FRUITING WIRE INSTALLED WINTER 2007-2008
- **PLANTED MARCH 2008**
- BAMBOO AND FOLIAGE WIRES INSTALLED SPRING 2008
- LOCAL SURVEYOR STAKED OUT ADDITIONAL 4.5 ACRES IN SUMMER OF 2008
- ROWS HERBICIDED AND RIPPED LATE SUMMER 2008
- POSTS, ANCHORS AND FRUITING WIRE INSTALLED WINTER 2008-2009
- **PLANTED MARCH 2009**
- BAMBOO AND FOLIAGE WIRES INSTALLED SPRING 2009
- CHECK DAMS REMOVED SUMMER OF 2009 – SEDIMENT CONTROL PONDS TO REMAIN INDEFINITELY

MACHINERY

- CRAWLER TRACK TRACTOR – 1.5 MPH VS. 2 WHEEL DRIVE RUBBER TIRE TRACTOR – 3.5 MPH
- LOW VOLUME 3-POINT HITCH SPRAYER
- 3-POINT HITCH BUSHHOG
- WEED WHACKERS
- 2 HARVEST TRAILERS – 8' FOR ROW PICKUP & 16' FOR WINERY TRANSPORTATION

LABOR

- 5 FULL TIMERS, INCLUDING ME, FOR 14.5 ACRES VINES INCLUDING 226 ACRE FARM
- STEEP VINEYARD REQUIRES TWICE AS MUCH LABOR TIME - FATIGUE FACTOR

WATER

- REMOTE LOCATION WITHOUT ELECTRICITY
- INSTALLED SOLAR WELL PUMP USED OUT WEST ON LARGE CATTLE RANCHES
- SOLAR PUMPED WATER INTO TWO 1500 GALLON UNDERGROUND CONCRETE TANKS
- GRAVITY DOWN TO PESTICIDE BUILDING

WHAT HAS WORKED

- SMALLER VINES, SMALLER BERRIES AND MORE OPEN CANOPY THAN ORIGINAL VINEYARD
- SOILS DRY OUT FAST AFTER RAINS
- VINES STOP SHOOT AND LEAF GROWTH AT VERAISON
- FRUIT AND RESULTING WINE OF HIGHER QUALITY THAN ORIGINAL VINEYARD

WHAT PROBLEMS HAVE OCCURRED

- LARGE SURFACE ROCKS IN SOME ROWS – THOSE ROWS FLAGGED FOR DOWN HILL TRAFFIC ONLY
- EROSION ON STEEP HEADLANDS WHERE CRAWLER TURNS AROUND
- HARVESTING FRUIT – DOWN HILL ONLY

THINGS TO DO DIFFERENT

- TRAFFIC RESISTANT GRASS/OTHER PLANT TYPE IN HEADLANDS
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Vineyard floor management considerations on erodible sites

Tony Wolf
Virginia Tech

Virginia Tech
Invent the Future

What are the issues?

- **Potential for soil erosion, particularly on inclined surfaces, and particularly with bare soil**
- **Competition of cover crops with vines for water and nutrients**
- **Encroachment of perennial weeds (e.g., poison ivy and Virginia Creeper) over time**

Within and between row floor management

A good canopy – veraison

Surplus soil moisture:

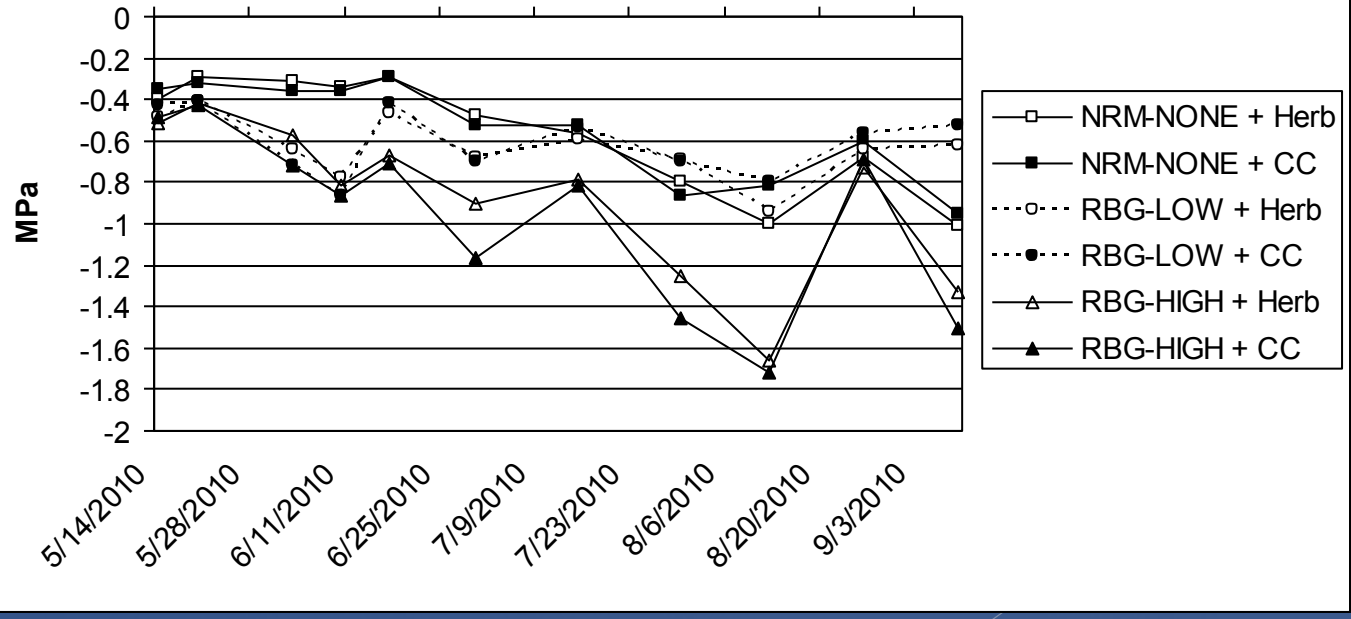
- ✓ Vigorous shoots with long summer laterals
- ✓ Large leaves
- ✓ Reduced fruitfulness, dense canopy
- ✓ Persistent vegetative development (well beyond veraison)

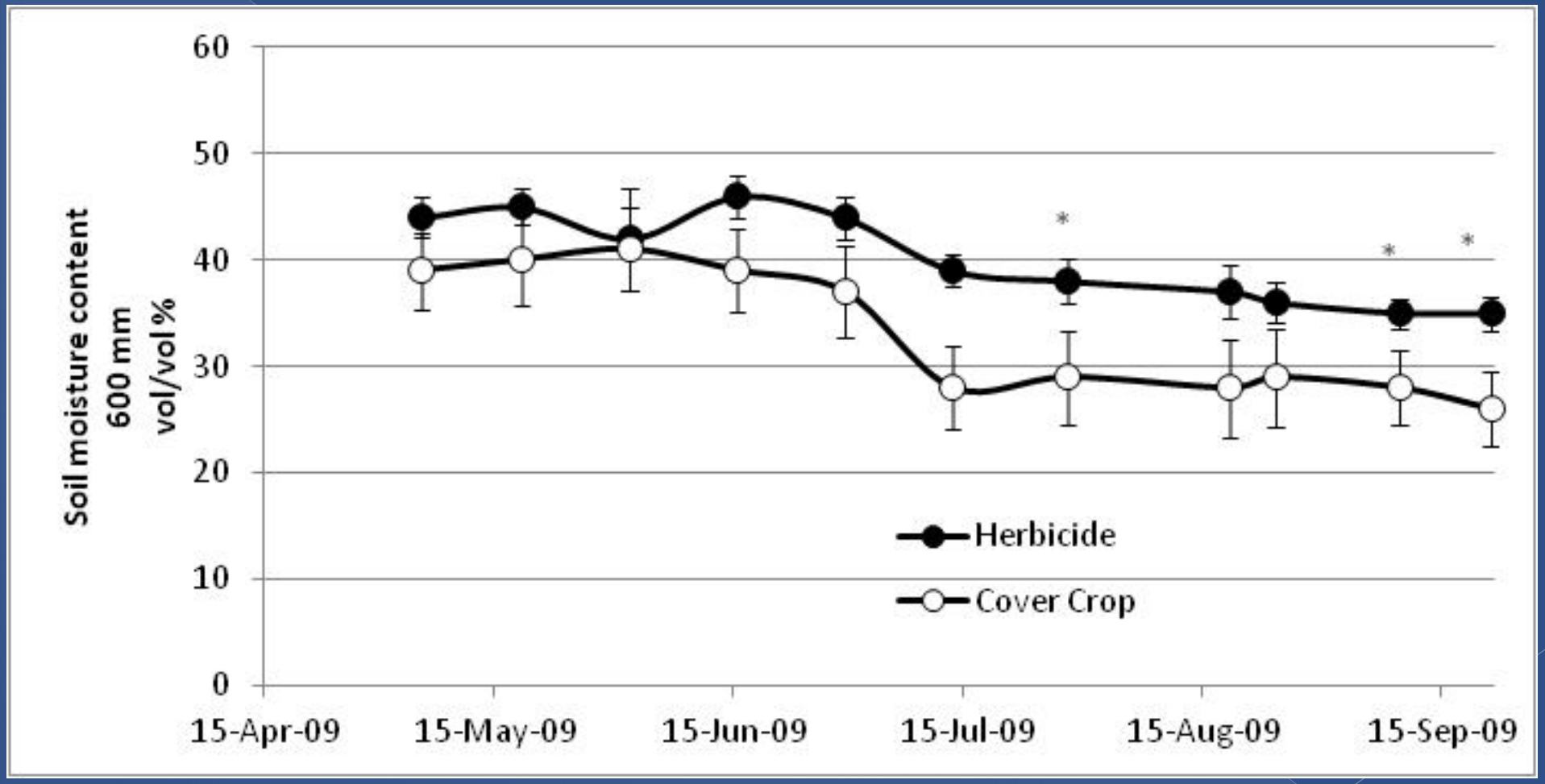
Veraison (late-July), Cabernet Sauvignon

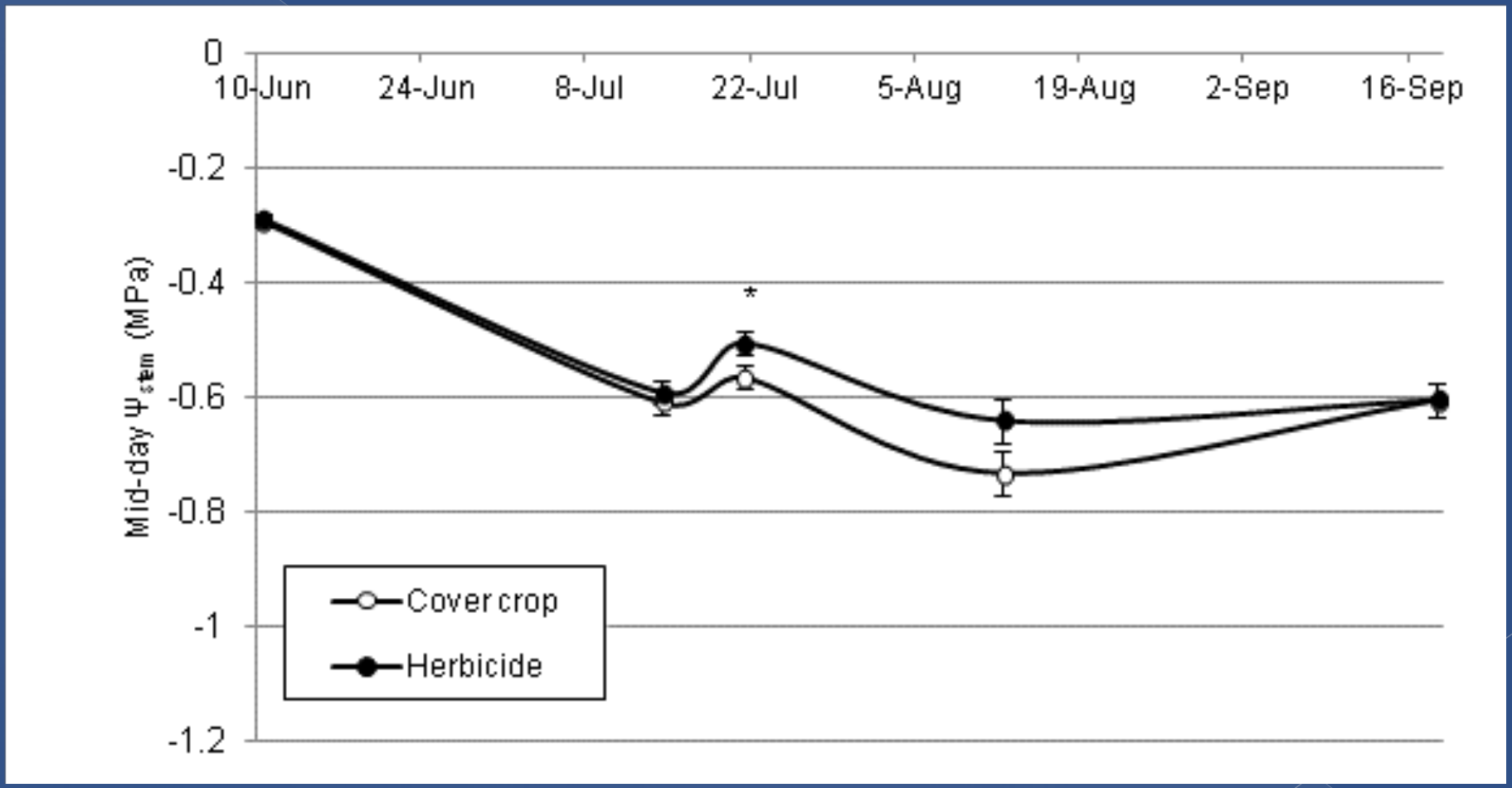
Hillside (slopes) vineyards have also driven the need for more complete vineyard floor cover cropping

The primary (but not only) means by which treatments are impacting vigor and vine size is through reduced water availability to vines

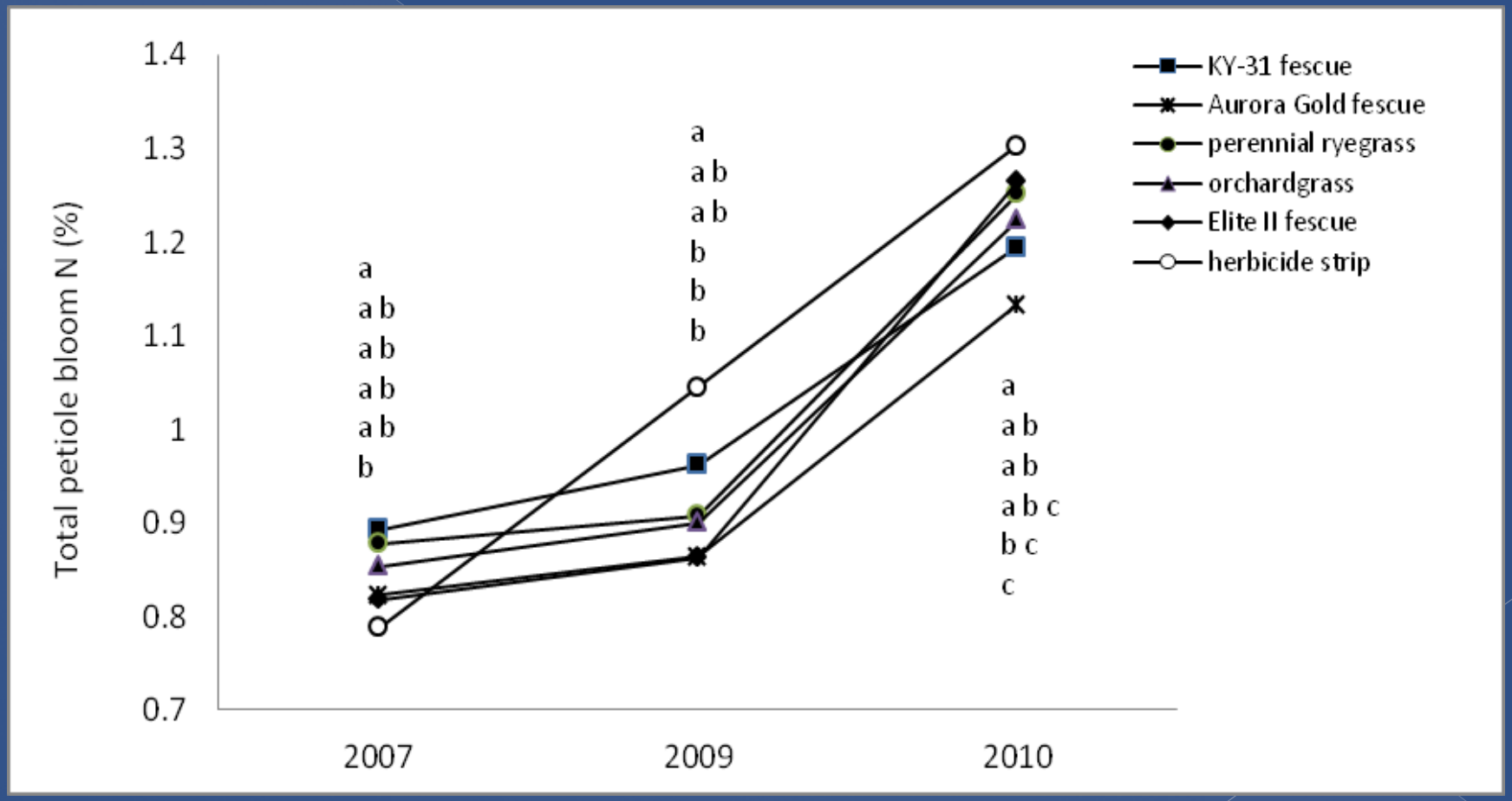
Figure 4. RM-Irr + UTGC effect on mean midday stem water potential, 2010




Soil moisture content
600 mm
vol/vol %
60
50
40
30
20
10
0
15-Apr-09
15-May-09
15-Jun-09
15-Jul-09
15-Aug-09
15-Sep-09
Herbicide
Cover Crop
*
*
*


0
10-Jun
24-Jun
8-Jul
22-Jul
5-Aug
19-Aug
2-Sep
16-Sep
-0.2
-0.4
-0.6
-0.8
-1
-1.2
Mid-day Ψstem (MPa)
*
Cover crop
Herbicide


1.63 %
organic matter
2.08 %
organic matter


Total petiole bloom N (%)
1.4
1.3
1.2
1.1
1
0.9
0.8
0.7
2007
2009
2010
a
a b
a b
a b
a b
b
a
a b
a b
b
b
b
a
a b
a b
a b c
b c
c
KY-31 fescue
Aurora Gold fescue
perennial ryegrass
orchardgrass
Elite II fescue
herbicide strip

Tissue concentration of nitrogen in leaf blades and petioles at two growth stages, Glen Manor, 2011 and 2012.

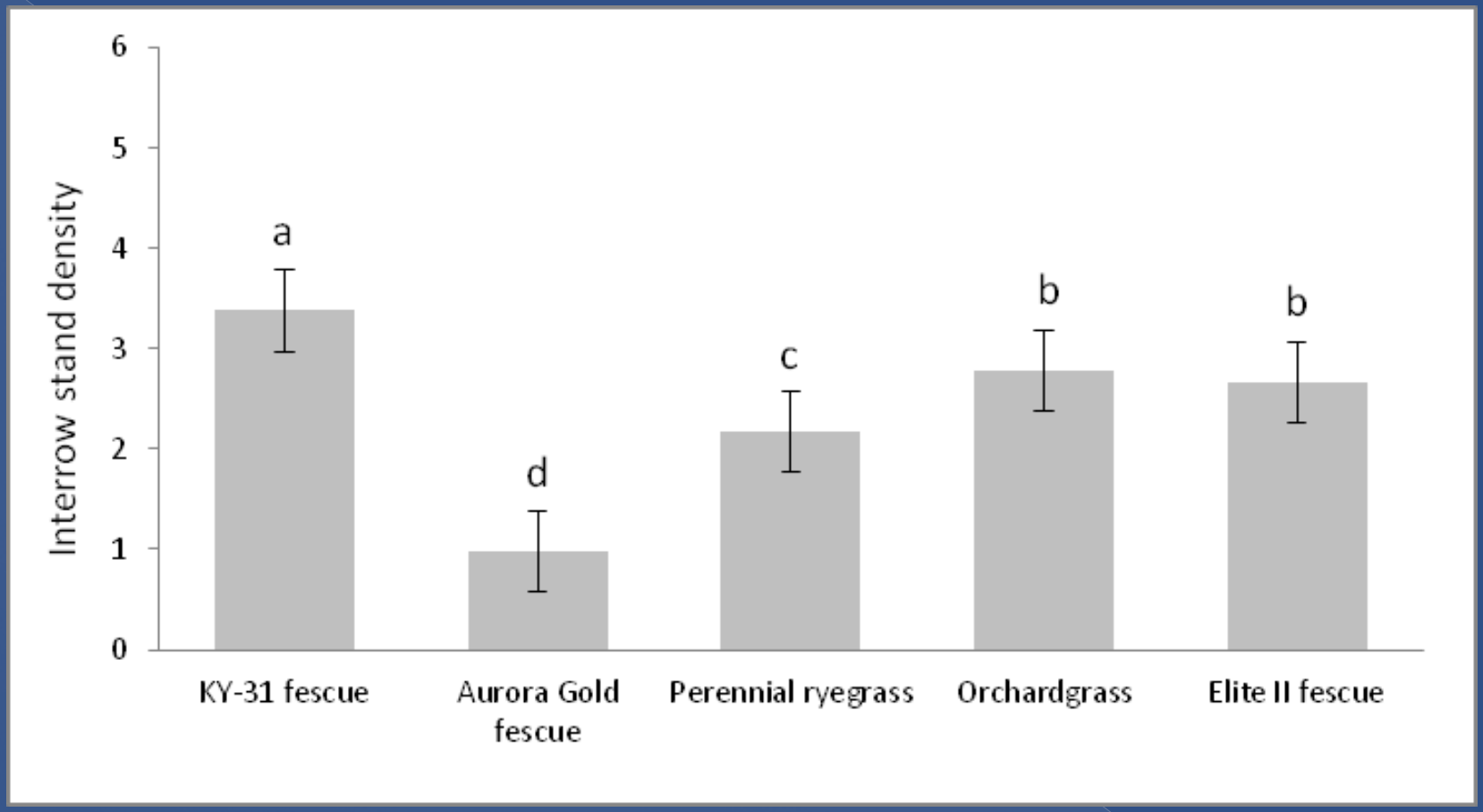
Nitrogen (%)							
	Bloom 2011		**Véraison 2011**		**Bloom 2012**		**Véraison 2012**
Treatment	Blade	Petiole	Blade	Petiole	Blade	Petiole	Petiole
Control	2.87	0.88	2.50	0.43	2.56	0.85	0.81
30 kg/ha N **soil** (bloom)	.	.	2.53	0.47	2.62	0.85	0.91
30 + 30 kg/ha N **soil** (bloom + véraison)	.	.	2.59	0.48	2.51	0.86	0.94
35 kg/ha N **foliar** (7 applications)	.	.	2.53	0.48	2.63	0.89	0.84

Petiole nitrogen concentration at bloom as affected by vineyard floor cover at two sites.

From Tesic et al., AJEV 58 (2007).

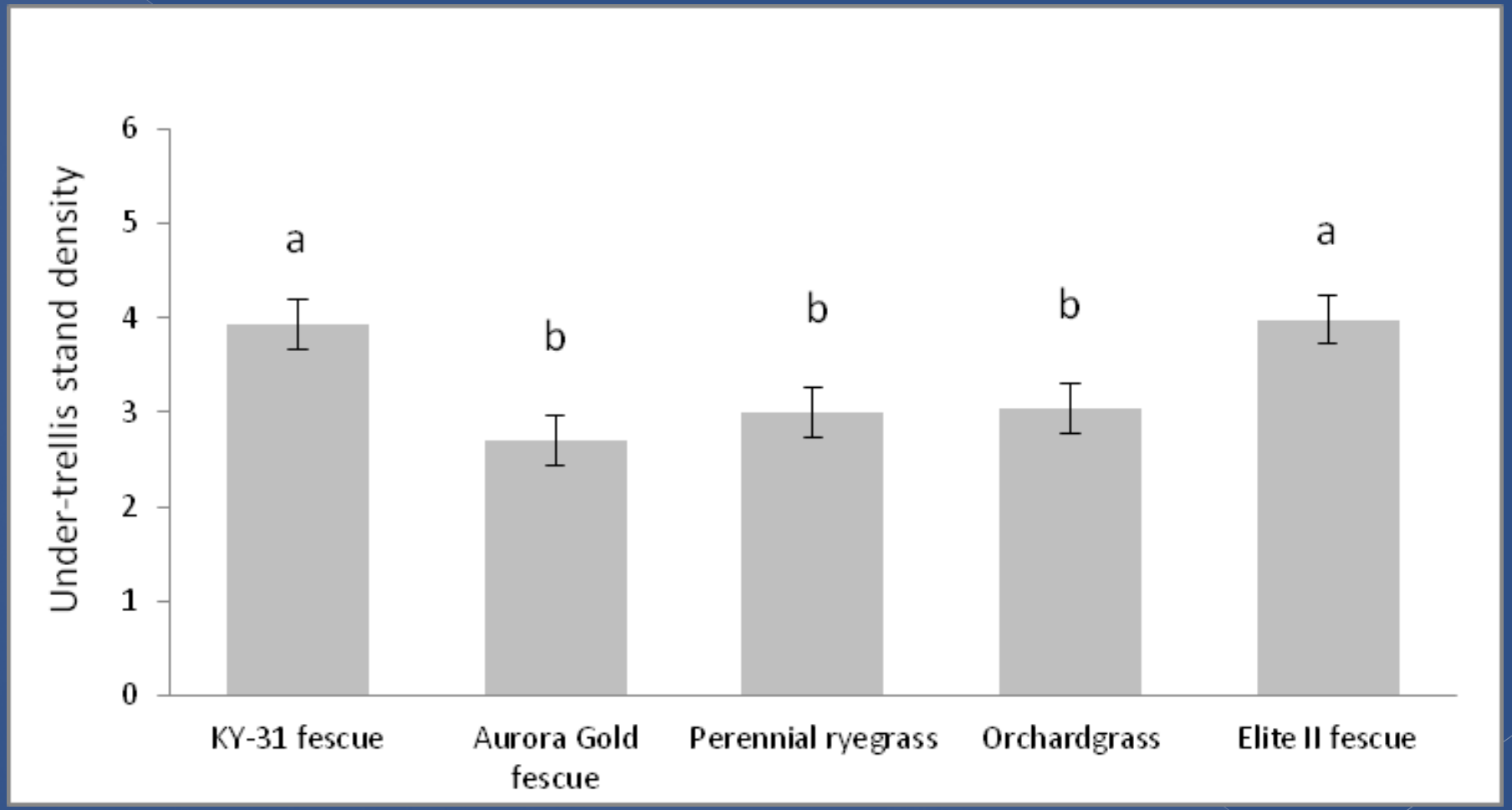
Vineyard	Season	Bare	Partial	Complete
Wagga Wagga	03/04	0.96 a	0.71 a	0.65 b
	04/05	1.39 a	1.05 a	0.83 b
Tumbarumba	03/04	1.79 a	1.65 b	1.46 c
	04/05	1.45 a	1.35 a	1.10 b

Comparison of different grasses, Gill Giese, Yadkin Valley, NC

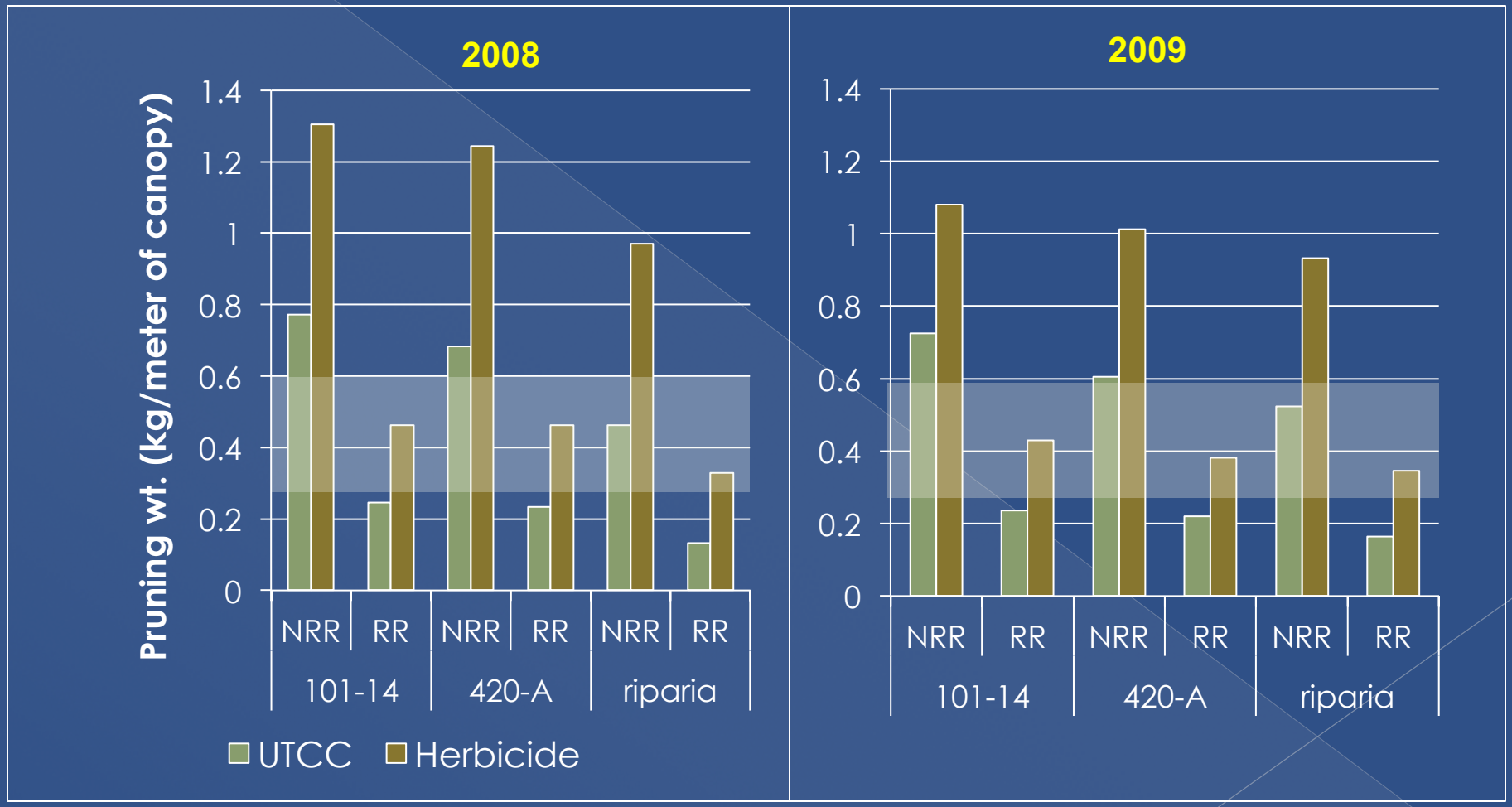


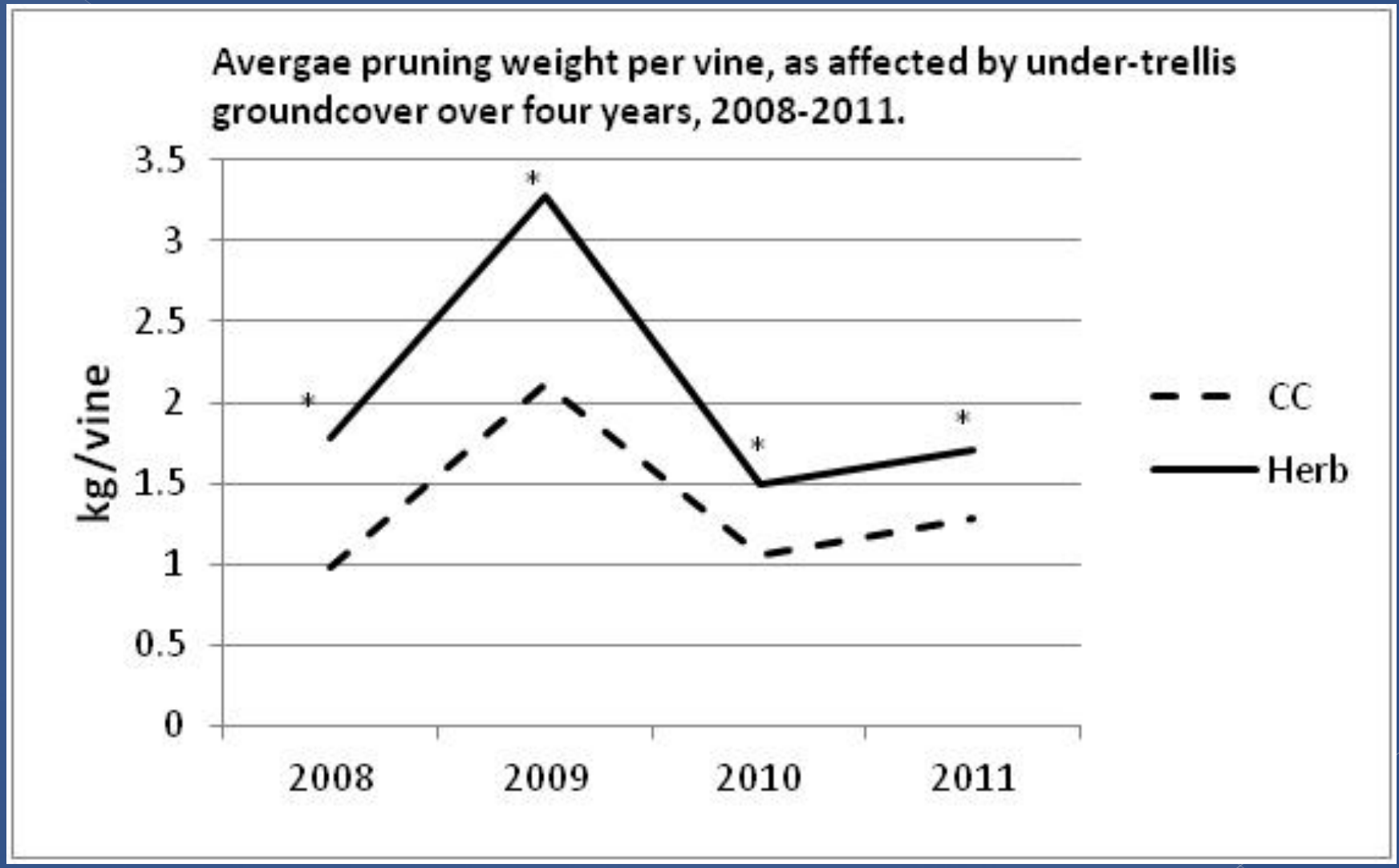
Turf-grass stand density scale: 6 = complete stand, 0% invasive plants/ bare ground; 5 = < 10% invasive species/bare ground; 4 = 10-25% invasive species/bare ground; 3 = 26-50% invasive species/bare ground; 2 = 51-75% invasive species/bare ground; 1= 76-100% invasive species/ bare ground.

Comparison of different grasses, Gill Giese, Yadkin Valley, NC



Cane pruning weights were reduced by under-trellis cover crop (47%), riparia rootstock (25%) and by root restriction (> 50%).




Avergae pruning weight per vine, as affected by under-trellis groundcover over four years, 2008-2011.
kg/vine
3.5
3
2.5
2
1.5
1
0.5
0
2008
2009
2010
2011
CC
Herb

Treatment effects on components of yield, 2008-2011

Treatment	Yield (kg/vine)	Cluster number/ vine	Cluster weight (g)	Berry weight (g)
UTGC				
CC	2.5 b	21.3 a	113 b	1.27 b
Herb	3.3 a	20.7 b	159 a	1.35 a
Stock				
101-14	2.7 c	20.9	125 c	1.28 c
420-A	2.9 b	21.3	134 b	1.30 b
riparia	3.2 a	20.9	150 a	1.36 a
Root Manipulation				
NRM	3.7 a	23.9 a	154 a	1.40 a
RBG	2.1 b	18.1 b	118 b	1.22 b

Not showing year effects nor interactions of main effects, which were sometimes present

Treatment and vintage effect on primary fruit chemistry, 2008-2011

Treatment	Soluble solids (°Brix)	pH	TA
UTGC			
CC	23.2 a	3.40 a	5.47 b
Herb	22.7 b	3.36 b	5.93 a
Stock			
101-14	23.0	3.41 a	5.53
420-A	22.9	3.35 b	5.81
riparia	22.9	3.39 a	5.76
Root Manipulation			
NRM	23.3 a	3.38 a	5.98 a
RBG	22.6 b	3.38 a	5.42 b
Year			
2008	22.9 b	3.34 c	5.30 b
2009	22.9 b	3.36 bc	6.66 a
2010	25.0 a	3.42 a	5.39 b
2011	21.1 c	3.40 ab	5.45 b

Treatment and vintage effect on berry color and phenolics, 2009-2011

Treatment	Total phenolics (A_{280})	Color density ($A_{420} + A_{520}$)	Color hue (A_{420}/A_{520})	Anthocyanins (A_{520})
UTGC				
CC	48.0 a	50.0 a	0.29	38.7 a
Herb	43.1 b	47.2 b	0.29	36.7 b
Stock				
101-14	46.2	50.4 a	0.29	39.2 a
420-A	45.4	48.0 b	0.29	37.1 b
riparia	45.1	47.4 b	0.29	36.8 b
Root Manipulation				
NRM	43.4 b	47.6 b	0.29	37.0 b
RBG	47.8 a	49.6 a	0.29	38.4 a
Year				
2009	40.6 c	44.7 b	0.28 b	34.8 b
2010	46.4 b	50.8 a	0.29 b	39.5 a
2011	49.8 a	50.4 a	0.30 a	38.7 a

Choice of intra-row cover crop

Perennial vs. annuals (consider need to hill and de-hill vines)

We're using creeping red fescue

When to use intra-row cover crop

Not during vineyard establishment (too competitive)

We sowed seed at end of 2nd year

Management considerations

To mow or not to mow?

We spot-treat the area immediately around trunks with herb.

Effect on vine nutrition

Reduced N levels are common … in both foliage and musts

Some concerns with voles

Weed management

- Insufficient vine size/vigor situation
- Use of pre-emergent vs. post-emergent herbicides

Perennial weed management issues

Nutrient management

- Relationship to soil moisture
- Nitrogen, phosphorus and potassium
  - Grasses are generally net N users
- Legumes as a source of vine nitrogen?
  - 50 # or more N/acre fixed
  - Available to vine principally only as cover crop is incorporated into soil
- How to apply fertilizer for preferential benefit of vine vs. cover crop?

Summary

Tractor Overturns

No other farm machine is so identified with the hazards of production agriculture as the tractor. According to the Virginia Farm Bureau Federation, tractor overturns are the number one cause of farm fatalities in Virginia. Understanding a few key components of tractor stability and basic procedures can reduce the likelihood of rollover.

Center of Gravity - A tractor's center of gravity is the point where all parts balance one another. On a two-wheel drive tractor (on level ground), the center of gravity is typically 10 inches above and two feet in front of the rear axle (in the center), which is about where the operator's feet are located. The center of gravity on a four-wheel drive and center-articulating tractor is located slightly more towards the front of the tractor. This results in approximately 30 percent of the tractor's weight on the front axle, and 70 percent on the rear axle.

Stability Baseline - The stability baseline of a tractor is made up of imaginary lines drawn between the points where the tractor tires contact the ground. Front, rear, and side stability baselines are established. **To avoid turnover, the center of gravity must stay within the tractor's stability baseline.** The tractor's center of gravity does not move, but its relationship with stability baselines may change due to:

- Added weight from attachments and items being hauled (center of gravity will shift to the front or rear of the tractor depending on what is attached or is being hauled),
- Driving on a slope (center of gravity shifts to the downhill side),
- Lifting a load (center of gravity shifts towards the load),
- Turning too fast (center of gravity shifts to the opposite direction you are turning in).

Rear Rollovers - Rear overturns happen fast! It may only take three-fourths of a second to reach the "point of no return". This "point of no return" may only be 75 degrees from a level surface before the tractor will continue to roll over.

- Many rear rollovers are the result of changing the tractor's center of gravity from hitching above the draw bar. Always hitch low on the tractor and pull slowly!
- Another cause for rear rollover is driving forward up a steep slope, or backing down a steep slope and applying the brakes. Always back up or drive down a steep slope.
- Driving forward when stuck in mud, snow, or on ice can result in a rear rollover. This occurs when the rear axle is unable to rotate, resulting in the front end lifting off of the ground, and possibly passing the "point of no return". Always back out or tow to the rear instead.

Side Rollovers - Side rollovers happen even faster! It only takes a half of a second to reach the "point of no return" for side rollovers. Common causes include:

- Driving across a steep slope or driving on roadways or slopes without locking rear brakes can result in side rollover.
- Driving too close to a ditch, culvert, or pond/creek.
- Towing a load that is too heavy.
- Turning while driving too fast.

Rollover Protective Systems (ROPS)

Rollover protective systems (ROPS) and wearing a seat belt are one of the best methods of preventing rollover deaths - they are 95 - 99 percent effective! Seat belts work with the ROPS to keep the operator in a safe zone within the ROPS structure. Many older model tractors can be retro-fitted with such systems. Note: Operators should not wear a seatbelt on tractors not equipped with ROPS!

ROPS do not prevent turnover, but they do limit the degree of rollover to 90 degrees - enough to prevent the operator from being crushed beneath the tractor. Always wear your seatbelt with ROPS! A tractor with an enclosed cab does not mean that it is equipped with ROPS. Check for a label on the ROPS system to verify that it is ROPS certified.

Some tractors are exempt from the ROPS requirement, which became effective on October 25th, 1976.

- Tractors with 20 horsepower or less,
- Tractors with mounted equipment that is incompatible with a ROPS cab or frame,
- Low-profile tractors used in orchards, vineyards, farm buildings, or greenhouses where the clearance of the frame/cab would interfere with normal operations. Note: If the low-profile tractor will be used in other locations, it must be equipped with a ROPS.

General Machinery Hazards

General machinery hazards include pinch points, shear points, hot surfaces, and rotating equipment. Injuries can be quite serious, including amputations or death! The employer must protect employees from coming into contact with hazards created by moving machinery parts. Guards must be capable of withstanding the force that a 250-pound person (leaning or falling against) would exert upon that guard. Guards must also be free of burrs, sharp edges, and sharp corners, and be securely fastened to the equipment (or

building). Where the location of the hazard is such that no employee can inadvertently come in contact with the hazard during operation, maintenance, or servicing.

Power Take-Offs (PTO) - Used correctly, PTOs can safely power feed grinders, bales, augers, mowers, chopers, and more. Used incorrectly, PTOs can rip off an arm, crush a skull, or sever a spine! A PTO can operate at around 1,000 rpm, or 16 rotations per second! A person can become entangled in rotating equipment in less than one second - making PTOs very dangerous. A person would barely have time to realize what was happening. Working around PTOs should be done with extreme care.

- Turn off the tractor and PTO before getting off of the tractor. Remove the key.
- Distance is the best way to avoid accidental entanglement with PTOs - keep at least three feet from the PTO.
- Never reach over or step over the PTO.
- Wear snug-fitting clothing without strings or loose ends.
- Keep long hair tied back and under a cap.
- Make sure that appropriate shields (guards) are in place, including the master shield, stub shaft shield, shaft shield, and implement shield.

Hydraulic Systems - Leaks in hydraulic hoses form a thin, high-pressure stream that quickly slices through skin, causing a serious injury called hydraulic fluid injection. Surgical removal of the fluid may be necessary, and if not properly cared for, gangrene may result. Always seek medical attention for this type of injury. Hydraulic systems can also fail without warning. Follow these tips:

- Use a piece of cardboard or paper to search for leaks - not your hand!
- Relieve pressure before disconnecting a hydraulic line.
- Never cross hydraulic lines. If the lines are not coupled correctly, the implement will not rise and drop as expected. Tape or color code lines to prevent mistakes.
- Never stand or work under raised equipment that is not supported by an approved lift support device.
- Keep ends of hoses and connections free from dirt and debris.

Roadway Hazards

Rural roads can often be more deadly than interstates! Unfortunately, it is often necessary to operate farm machinery on rural roadways. A slow moving vehicle emblem is required for tractors traveling 25 mph or less. Note: Modified vehicles or just driving slowly in a farm truck, for example, is not considered a slow moving vehicle. Often, tractor operators on roadways will motion vehicle traffic to go ahead and pass the tractor. For liability reasons, this should be avoided. Let the vehicle driver make the decision to drive around the tractor. If there is an accident, it will be their responsibility and not yours.

- Place slow moving vehicle emblems on the very end of the load being pulled. If no load is being pulled, the emblem should be placed on the tractor in a highly visible location. Emblems should be clean, clear, and not faded.

- Also recommended are flashing lights and an escort vehicle.
- Avoid traveling on roadways at night when visibility is poor.

Source – Virginia Tech EHSS
http://www.ehss.vt.edu/programs/FAR_tractor_safety.php#A

Considerations to Control Erosion on Steep Terrain

Mike Liskey – District Conservationist - USDA Natural Resources Conservation Service

Recommendations During Initial Site Visit (12/12/2005):

- Leave buffers along all drainageways
- Establish permanent grass, or temporary cover if outside of seeding dates, **ASAP** after clearing forest
- Soil test (pH/nutrients) to achieve a strong stand of grass, **BUT** keeping needs of grapes in mind
- Install "turnouts" in rows to divert runoff onto a thick grass sod
- Install rock check dams or **properly installed** straw bale barriers in areas of concentrated water flow; the steeper the slope, the closer the bales should be together
- Consider clearing in stages to minimize disturbed areas and reducing runoff

Follow-up Visit (8/21/2006):

- Former gully is now a broad drainageway stabilized with grass
- Two detention ponds installed to store and gradually release runoff to lessen d/s impacts
- Several "diversions" had been plowed on approx. contour to divert runoff; DO NOT allow runoff to flow unimpeded from top of slope to bottom; this increases soil erosion!
- Entire cleared area seeded to millet as temporary cover until permanent grass cover could be planted in late August – early September

Key Points:

- Glen Manor **spent time up front** getting things ready before planting the vines
- They had a conservation plan that detailed steps to be taken; a plan serves as a road map that specifies what actions should be taken and when
- This likely saved time and money in the long run; large scale land disturbance and clearing attracts a lot of attention; you do not want to be shut down mid-way through your project having to develop a conservation or E&S control plan and/or obtaining necessary permits
- Remember, you're planting a crop that may live for 25 – 30 years and that costs approx. $15,000 to $18,000/acre to establish; **THERE IS ABSOLUTELY NO NEED TO RUSH!!!!**
- ***You cannot fool Mother Nature, but must work with her!!!!***

Resources to Help with Runoff and Erosion Control:

- USDA NRCS: Google "va nrcs"; choose VA NRCS Contacts; choose Local Service Centers; click on Local Service Center Map; click on map of VA; click on county property is located in for local NRCS office contact information
- Consulting engineers who develop erosion and sediment control plans
- Other private consultants

Other Resources:

- NRCS Web Soil Survey: http://websoilsurvey.nrcs.usda.gov
- Virginia Department of Forestry: Google "va dept of forestry"; choose "contact us"; click on "find your county forester"; select the county. They can advise on regulations governing clearing forestland. It's possible you have marketable timber that can even offset some of the clearing costs

Virginia Cooperative Extension

Virginia Tech • Virginia State University

Grapevine balance/canopy management workshop

Cooperative Extension In-service training program

AHS Jr. AREC http://www.arec.vaes.vt.edu/alson-h-smith/index.html

12 June 2013

7:30 am **On-site registration at AHS Jr. AREC**

8:00 am: **Defining vine vigor, vine size and vine balance**
Sara Spayd, North Carolina State University and Tony Wolf, Virginia Tech

9:00 am: **Pre-plant considerations for vine size and balance management**
Fritz Westover, Central Coast Vineyard Team
Vineyard design considerations that impact vine size and need for canopy management

10:00 am: **Break**

10:30 am: **Post-planting considerations for canopy management**
Tony Wolf, Virginia Tech
Practical means of assessing grapevine canopies and remedial methods of achieving a more optimal vine balance and canopy architecture.

Noon: **Lunch**

12:45 pm: **Small group exercises in canopy assessment**
Tony Wolf, Tremain Hatch, Fritz Westover and Cain Hickey
Demonstration and hands-on exercises with practical, rapid canopy scoring techniques. Smaller groups will work with vines that have a range of canopy characteristics.

2:15 pm: Break

2:30 pm: **Small group exercises in canopy modification**
Tony Wolf, Tremain Hatch, Fritz Westover and Cain Hickey
Shoot positioning, lateral and basal leaf removal, cluster exposure goals, shoot hedging and other approaches to achieve desirable canopy architecture.

4:30 pm: Workshop recap/summary and adjourn

6:00 pm: **Catered dinner at the AHS AREC with local wines**

GRAPE & WINE QUALITY EASTERN U.S. INITIATIVE

the Southern Region small fruit consortium

Defining vine vigor, vine size and vine balance

Sara E. Spayd
Extension Viticulture Specialist
NC State University

NC STATE UNIVERSITY

Building a Vocabulary

- Building a vocabulary
- Vine growth
- What we do to grapevines
- What we do to grapevines does to the grapevines

What makes up the canopy?

- Shoots
- Leaves
- Fruit

Vocabulary of Canopies

- Canopy management: The positioning and maintaining bearing shoots and their fruit in a microclimate (phytoclimate) optimum for:
  - good fruit quality
  - inflorescence initiation
  - cane maturation
  - disease and insect control/suppression

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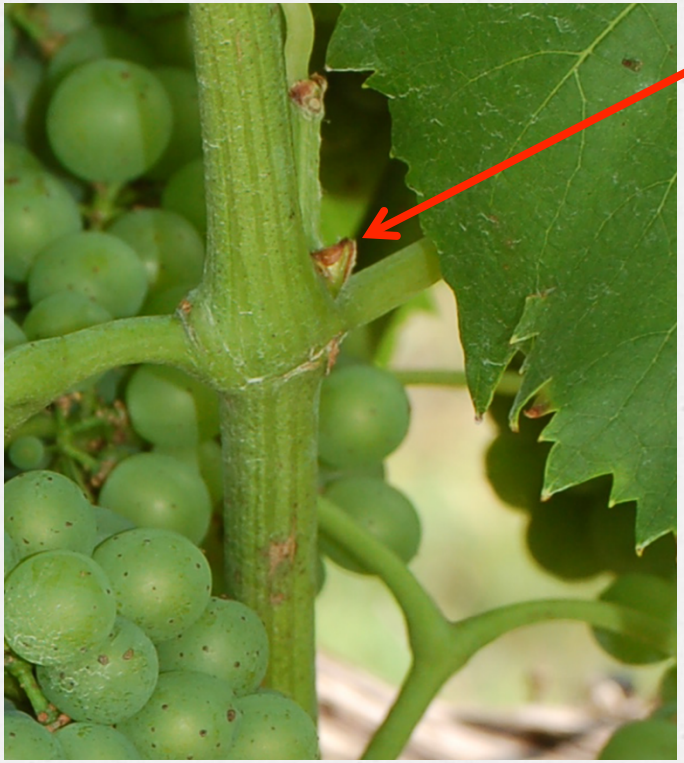

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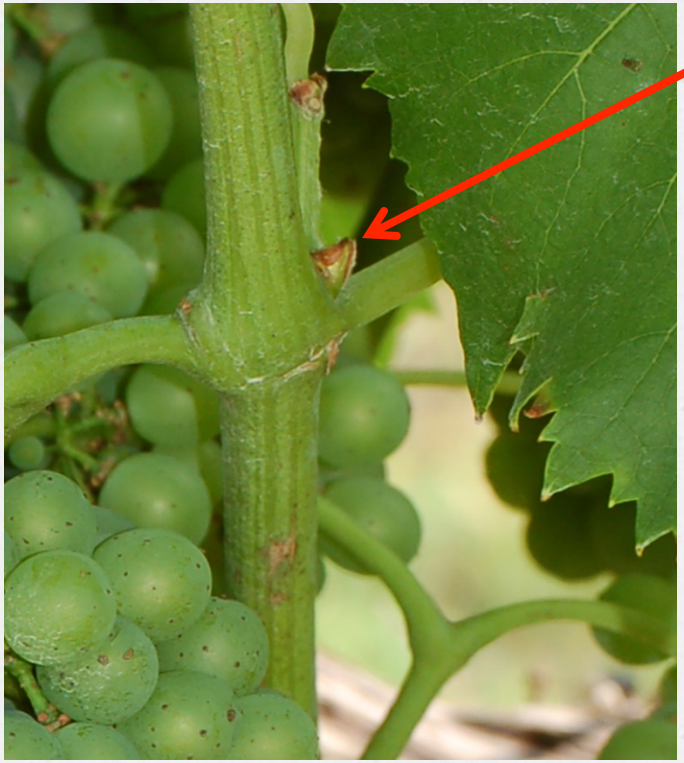

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  - Vegetative growth - canopy
    - Vine vigor
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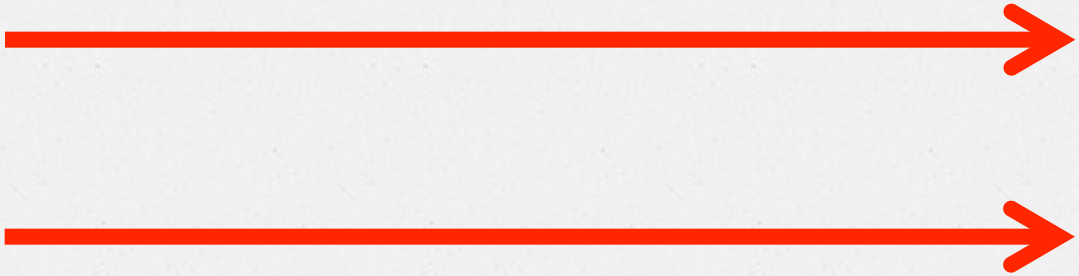

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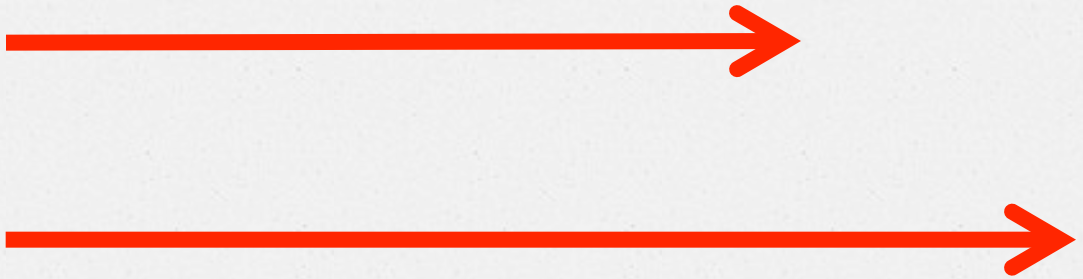

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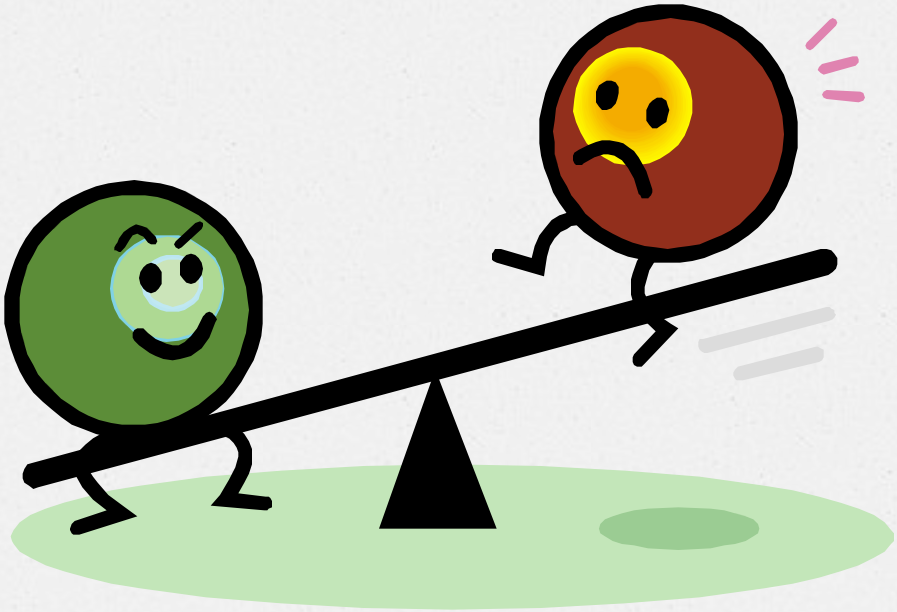
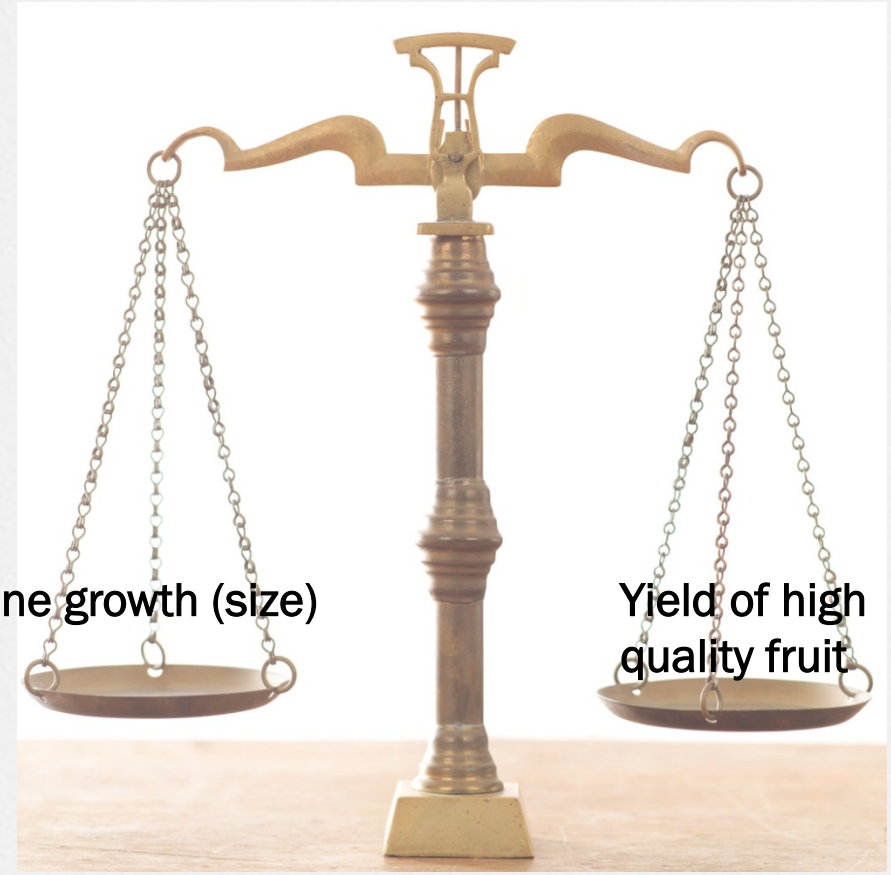


Vegetative growth

Fruit yield

Vine Capacity



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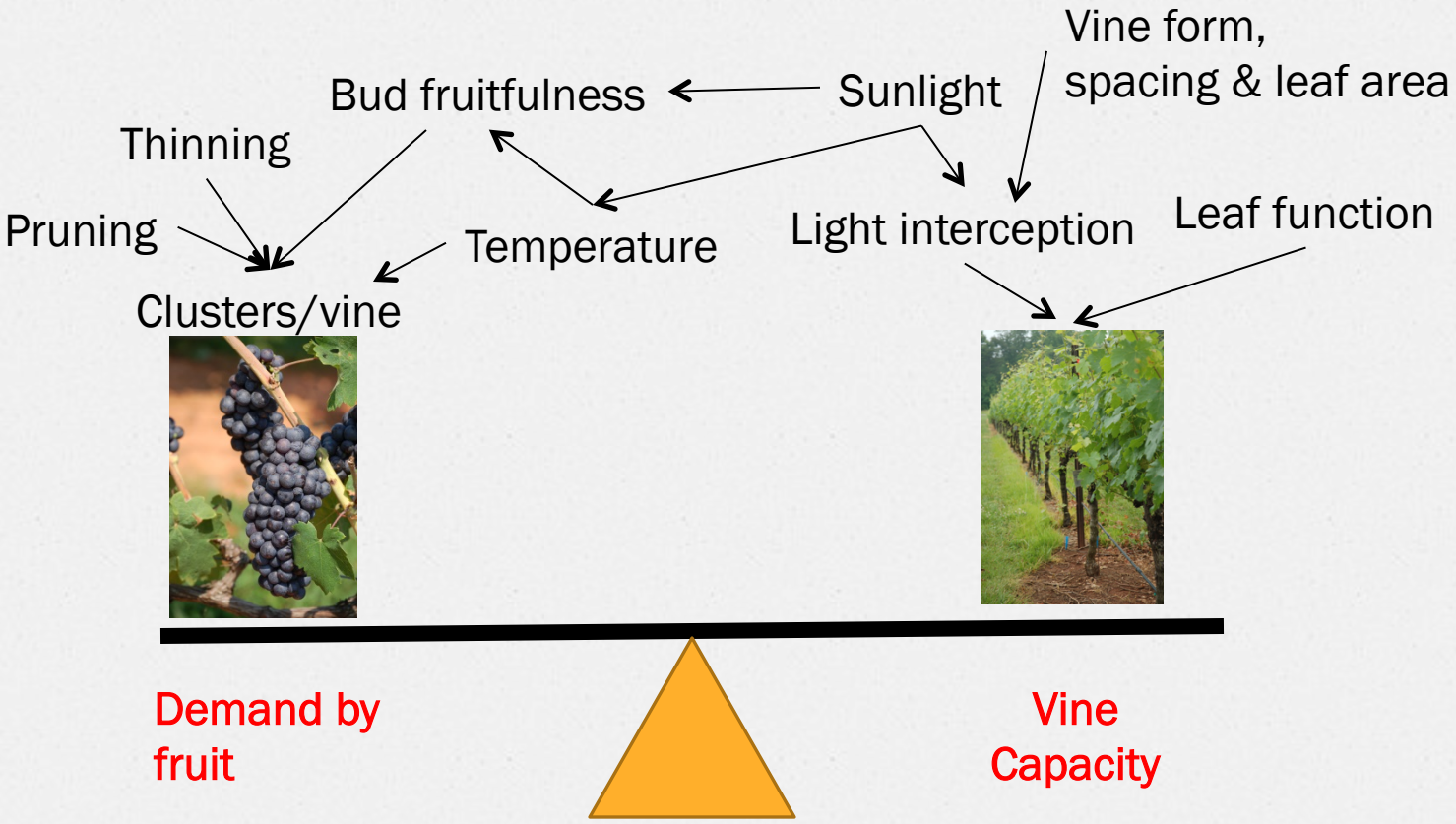


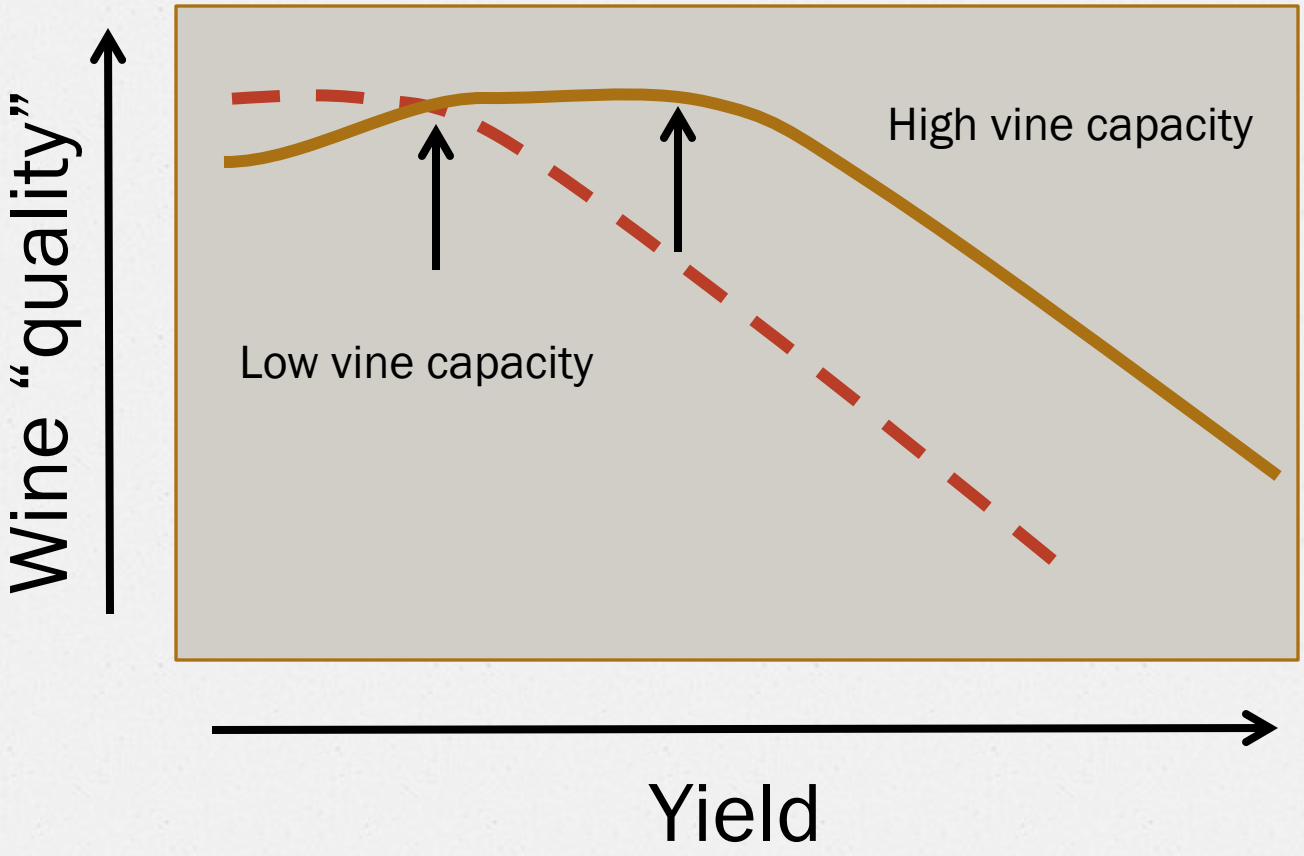
Modification of Lakso presentation

Site Characteristics

- High vigor site
  - High precipitation and/or high water holding capacity soil
  - Highly fertile, deep soil
- Low vigor site
  - Low precipitation and/or low water holding capacity soil
  - Low fertility and/or shallow soil

Do we manage these two vineyards the same?
Do we crop them at the same level?

High capacity vs Low capacity



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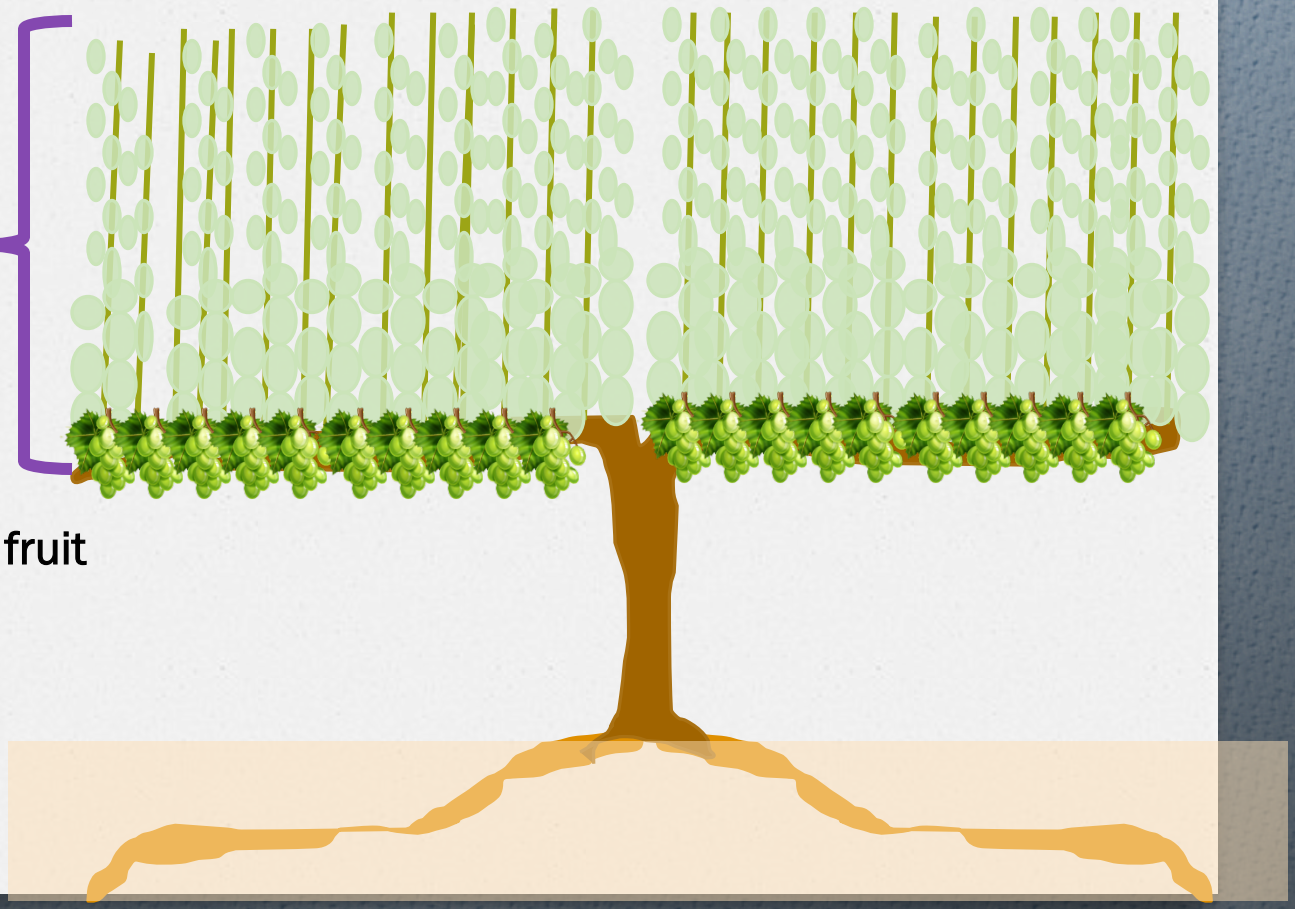

Canopy Removal

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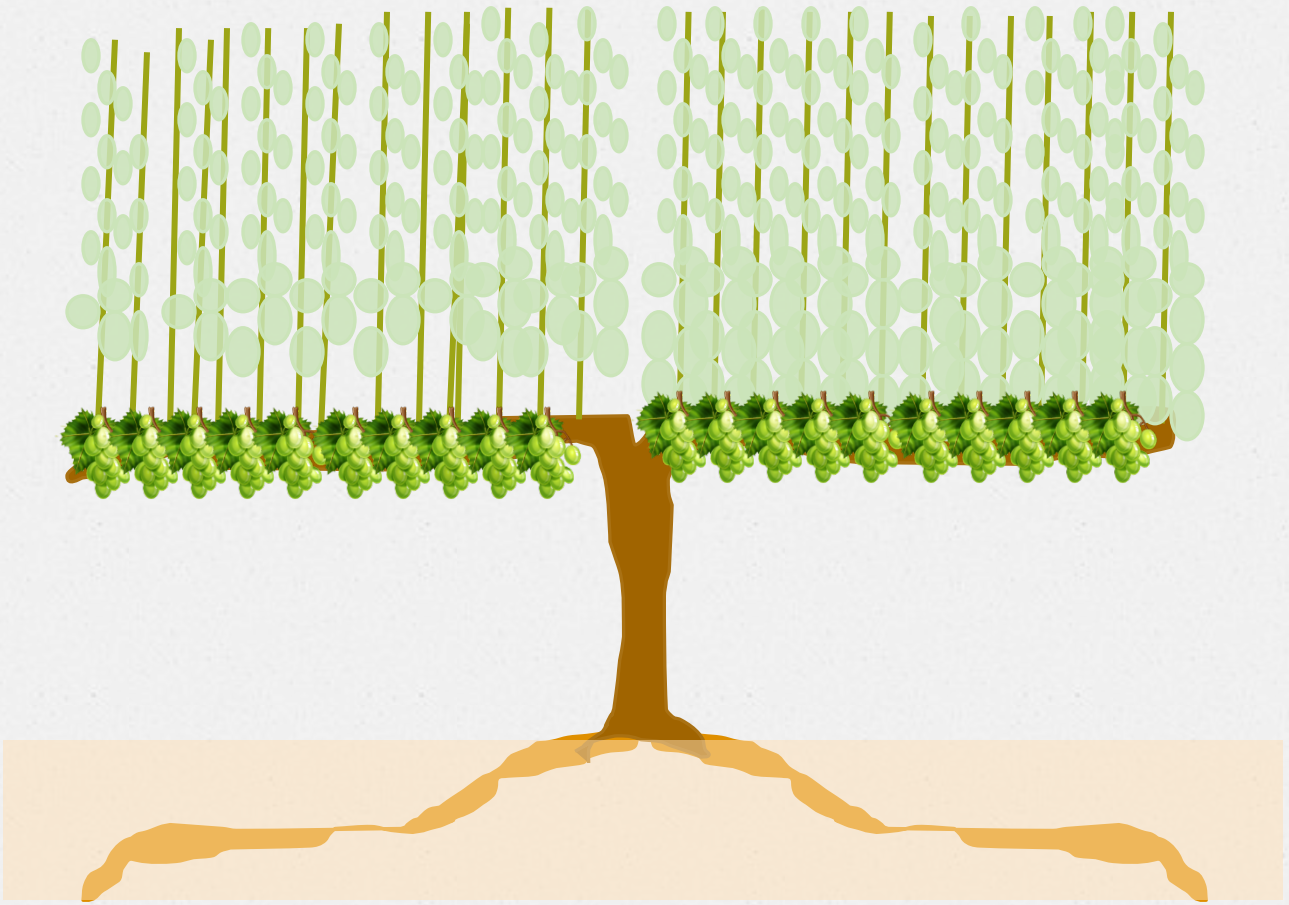

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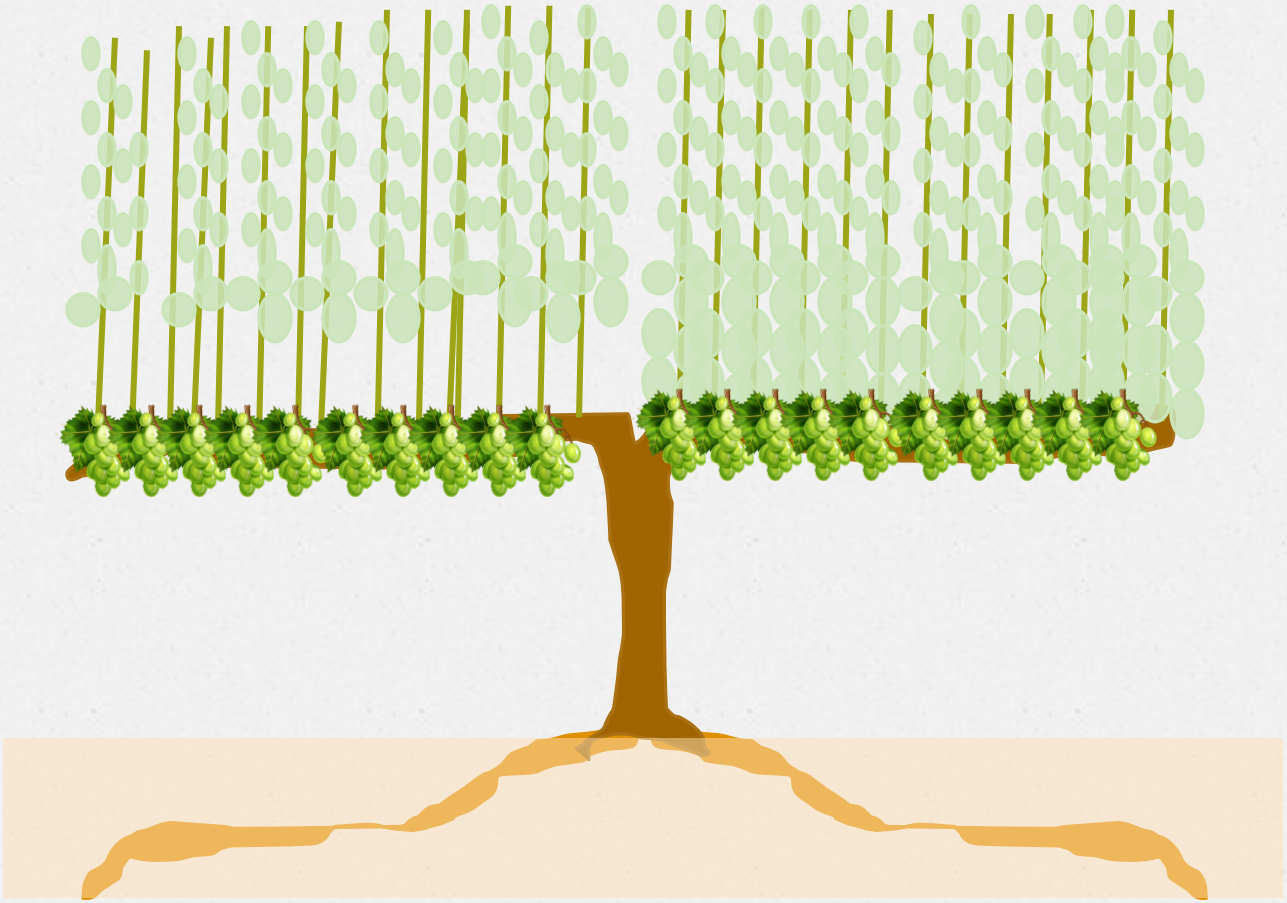
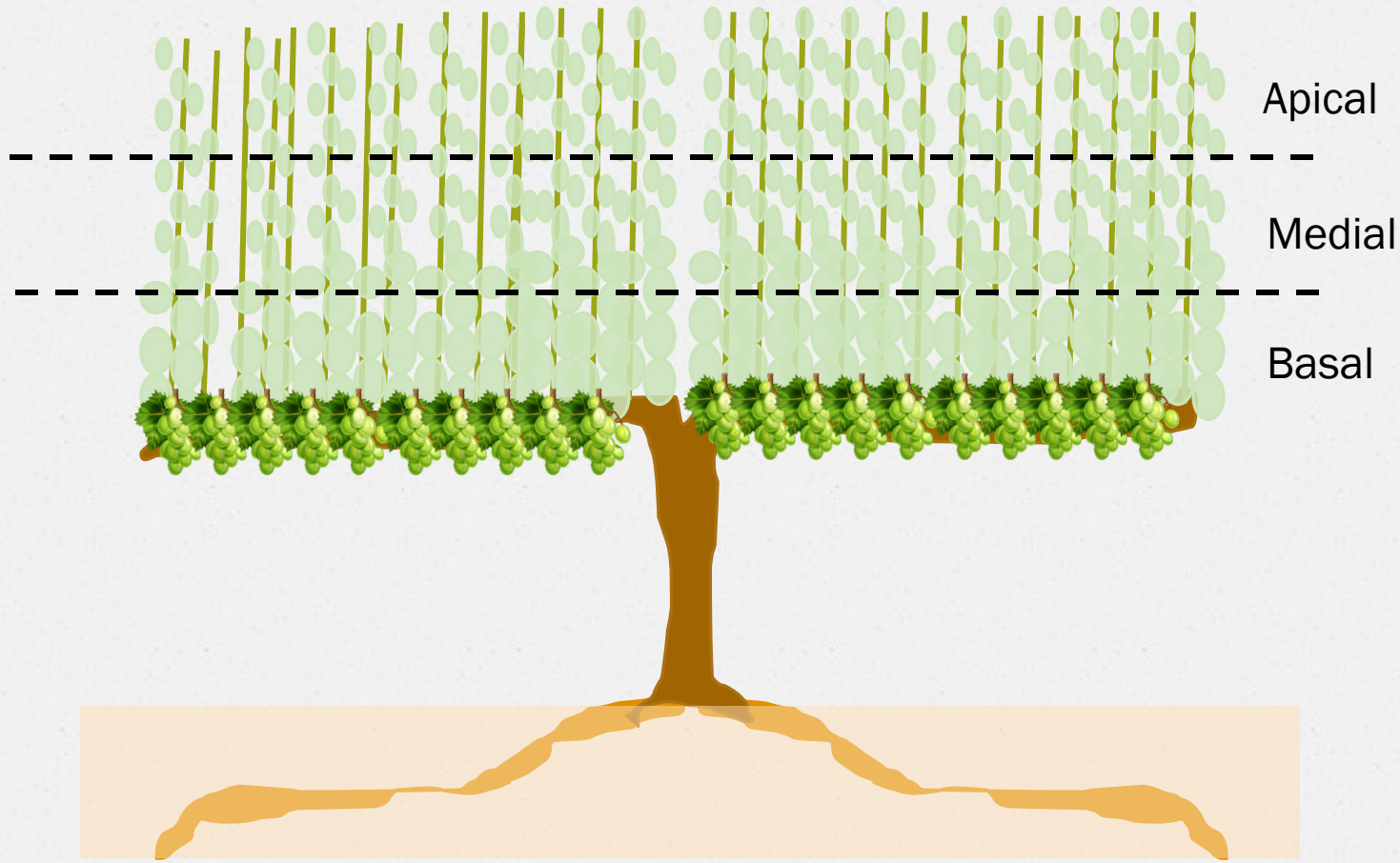


Leaf age, function, area



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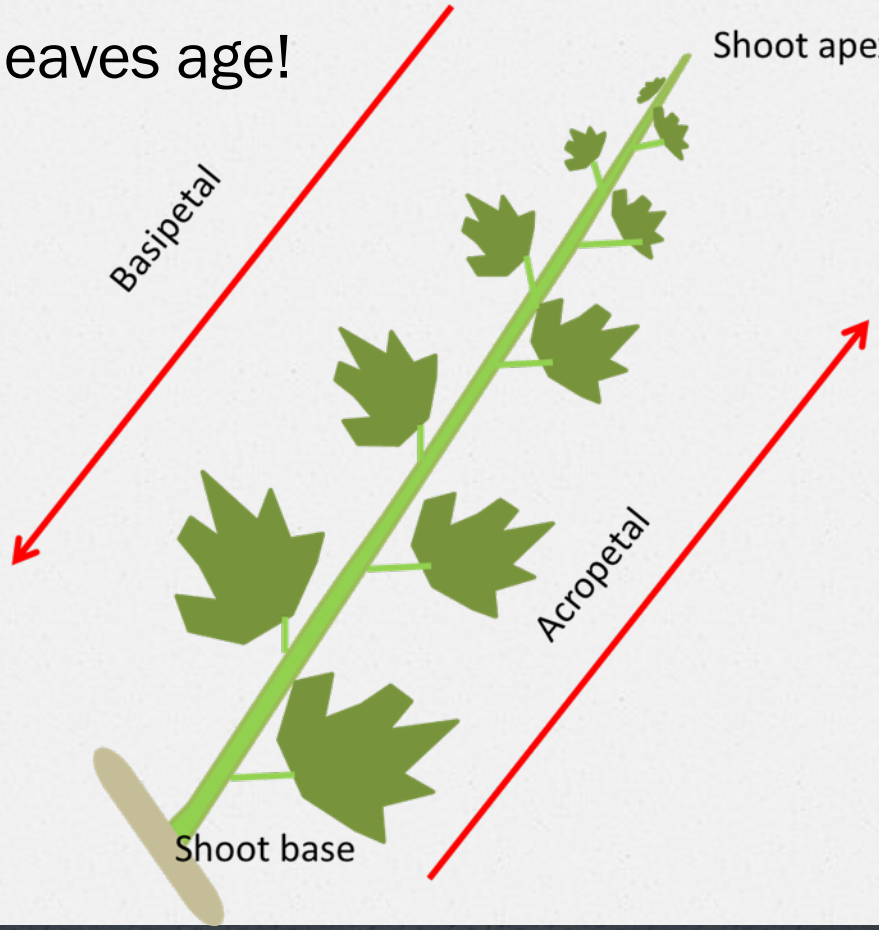

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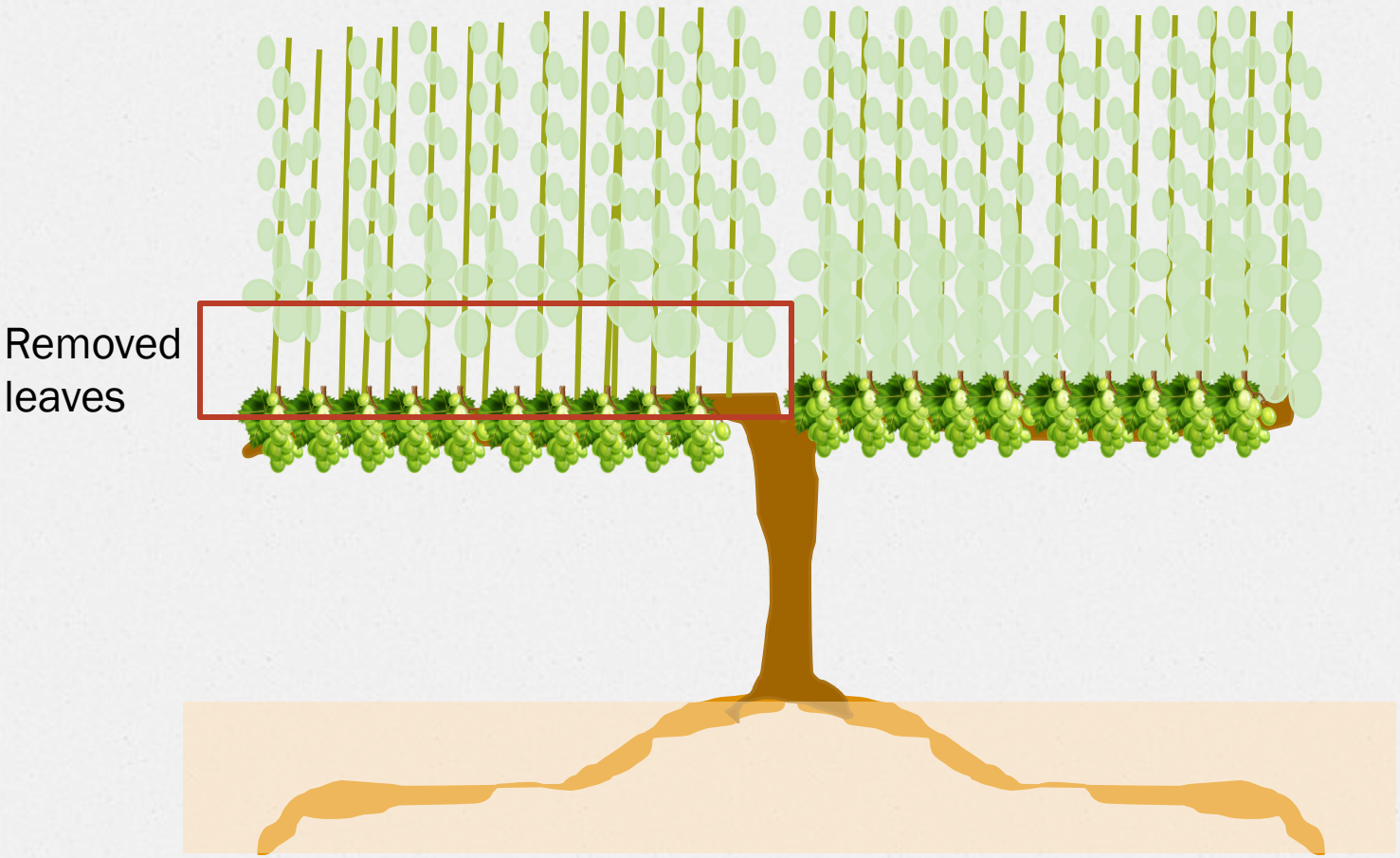

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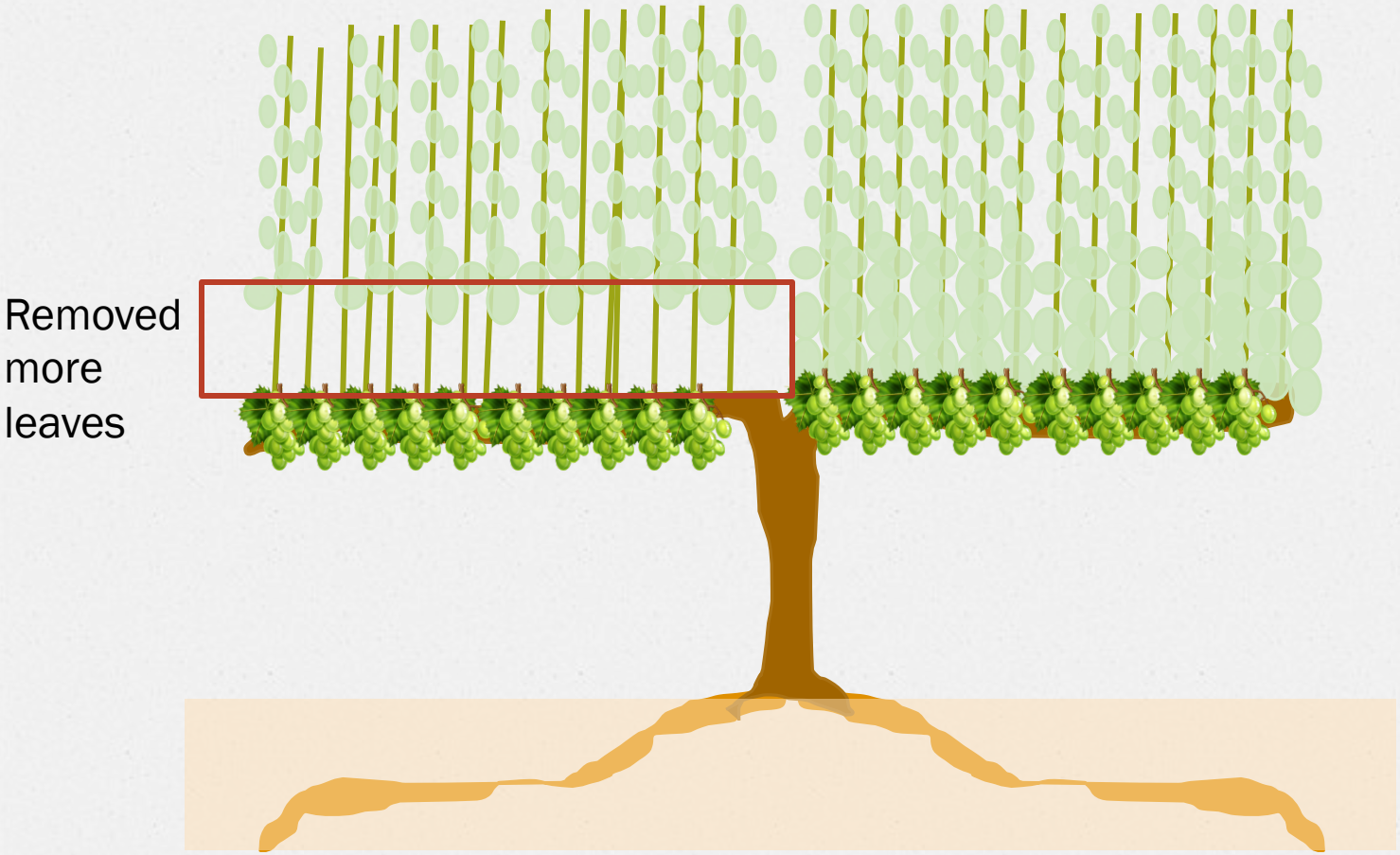

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Summary

- Important to understand key concepts
  - Vine capacity
  - What trellis to use in what situation
  - Light exposure important
  - Leaves are also important

Questions

Defining vine vigor, vine size and vine balance

Sara E. Spayd
Extension Viticulture Specialist
NC State University

NC STATE UNIVERSITY

Building a Vocabulary

- Building a vocabulary
- Vine growth
- What we do to grapevines
- What we do to grapevines does to the grapevines

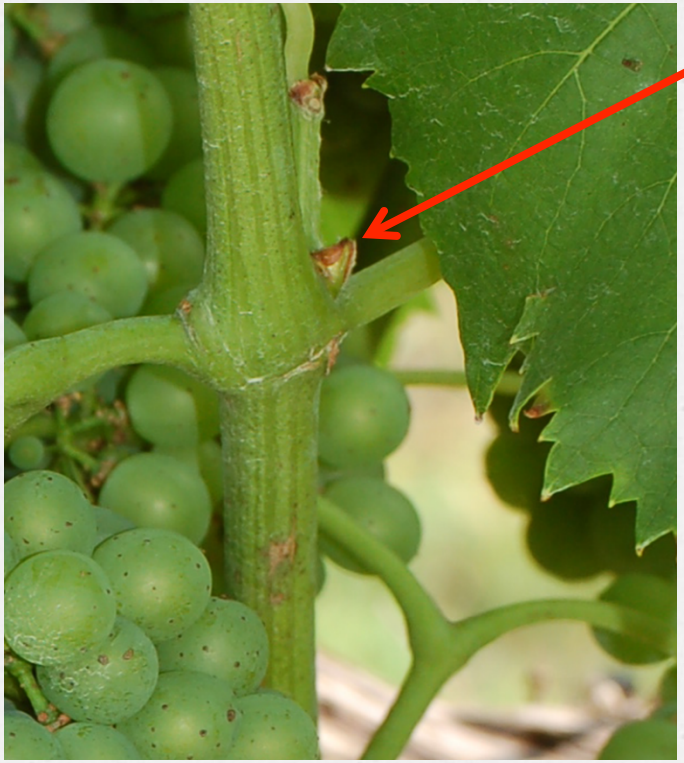
What makes up the canopy?

- Shoots
- Leaves
- Fruit

Vocabulary of Canopies

- Canopy management: The positioning and maintaining bearing shoots and their fruit in a microclimate (phytoclimate) optimum for:
  - good fruit quality
  - inflorescence initiation
  - cane maturation
  - disease and insect control/suppression

Current & Next Year's Crop



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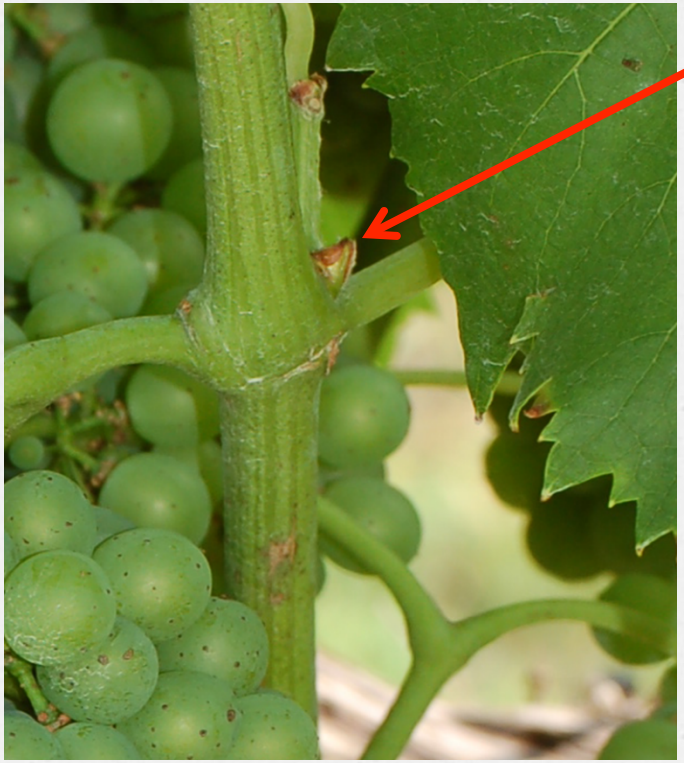

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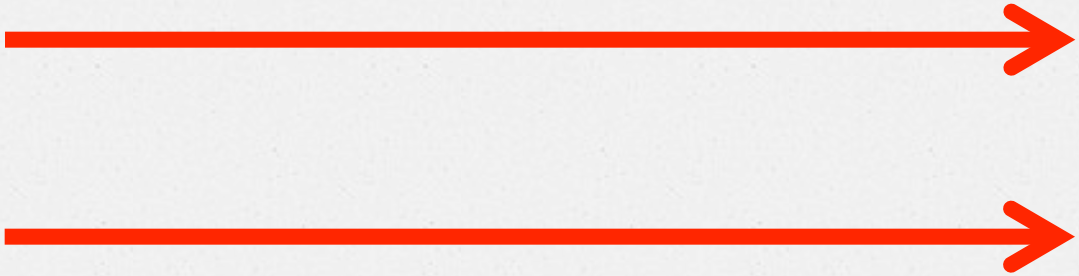

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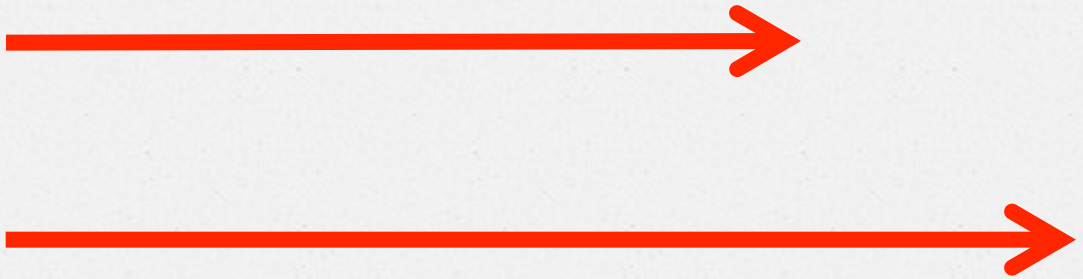

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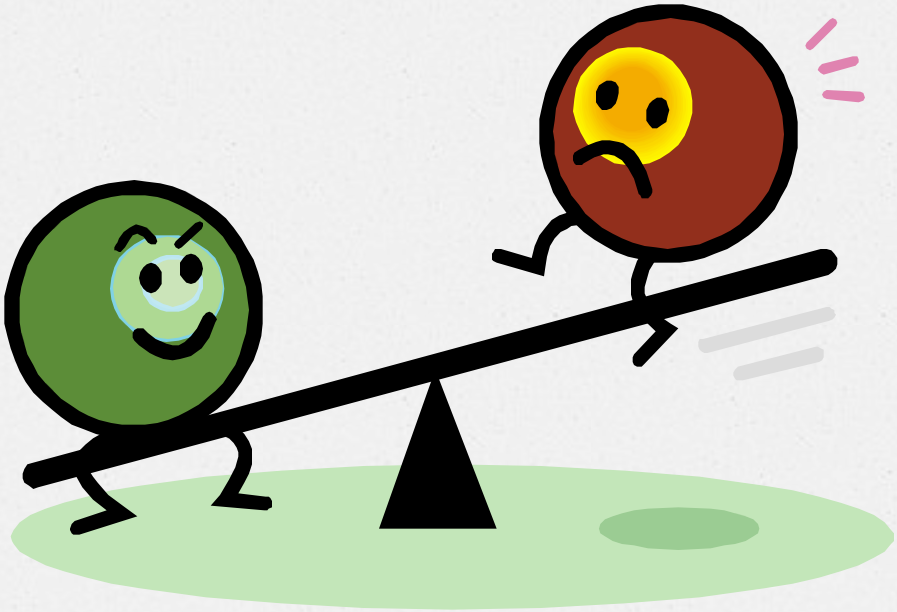

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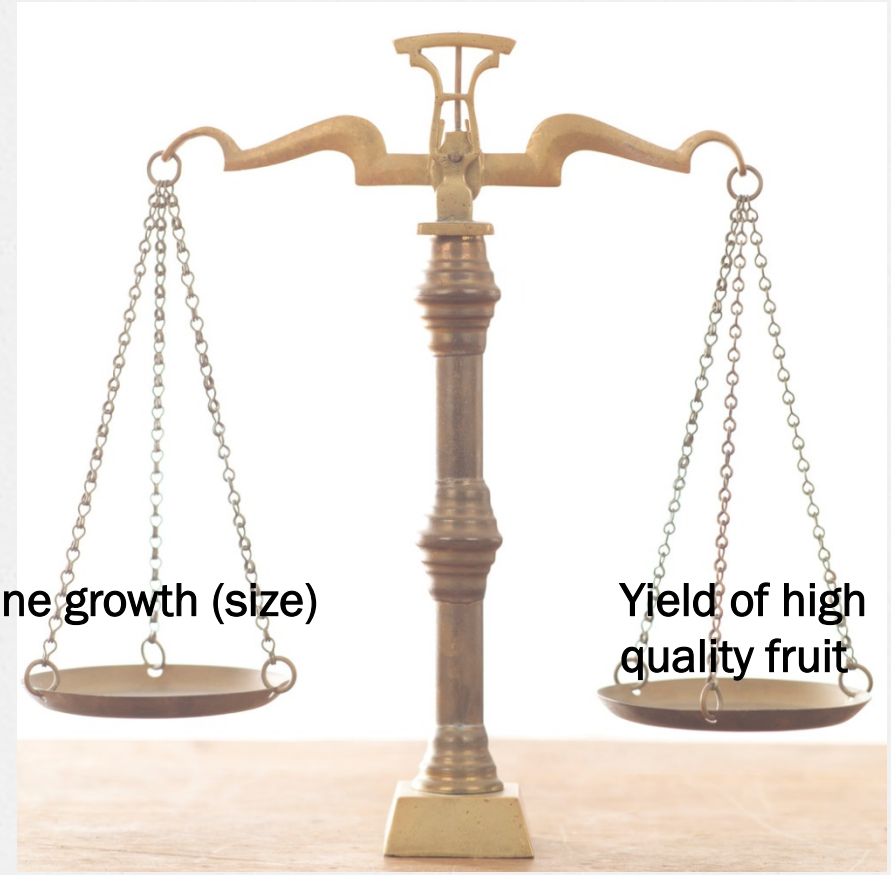

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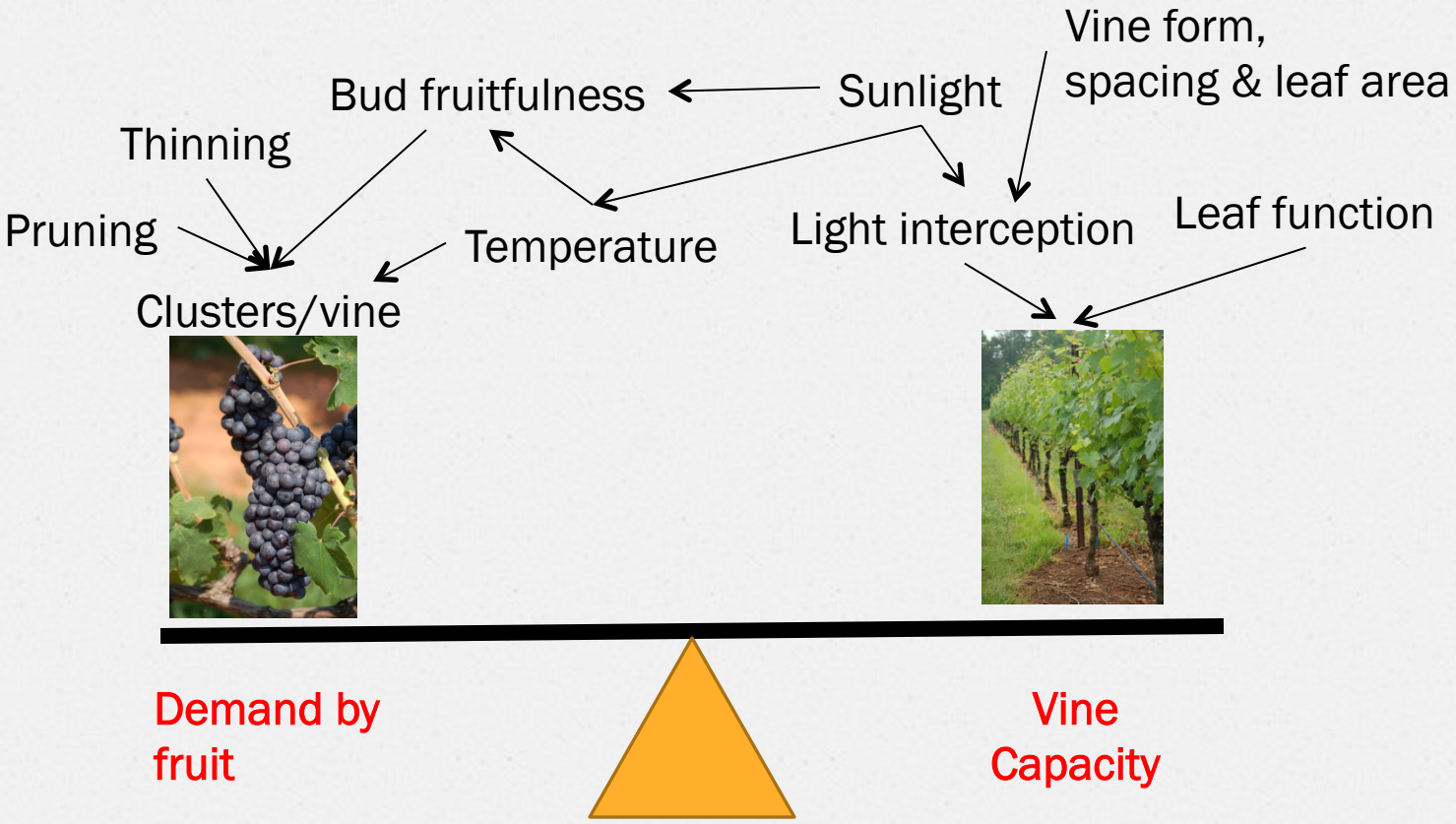

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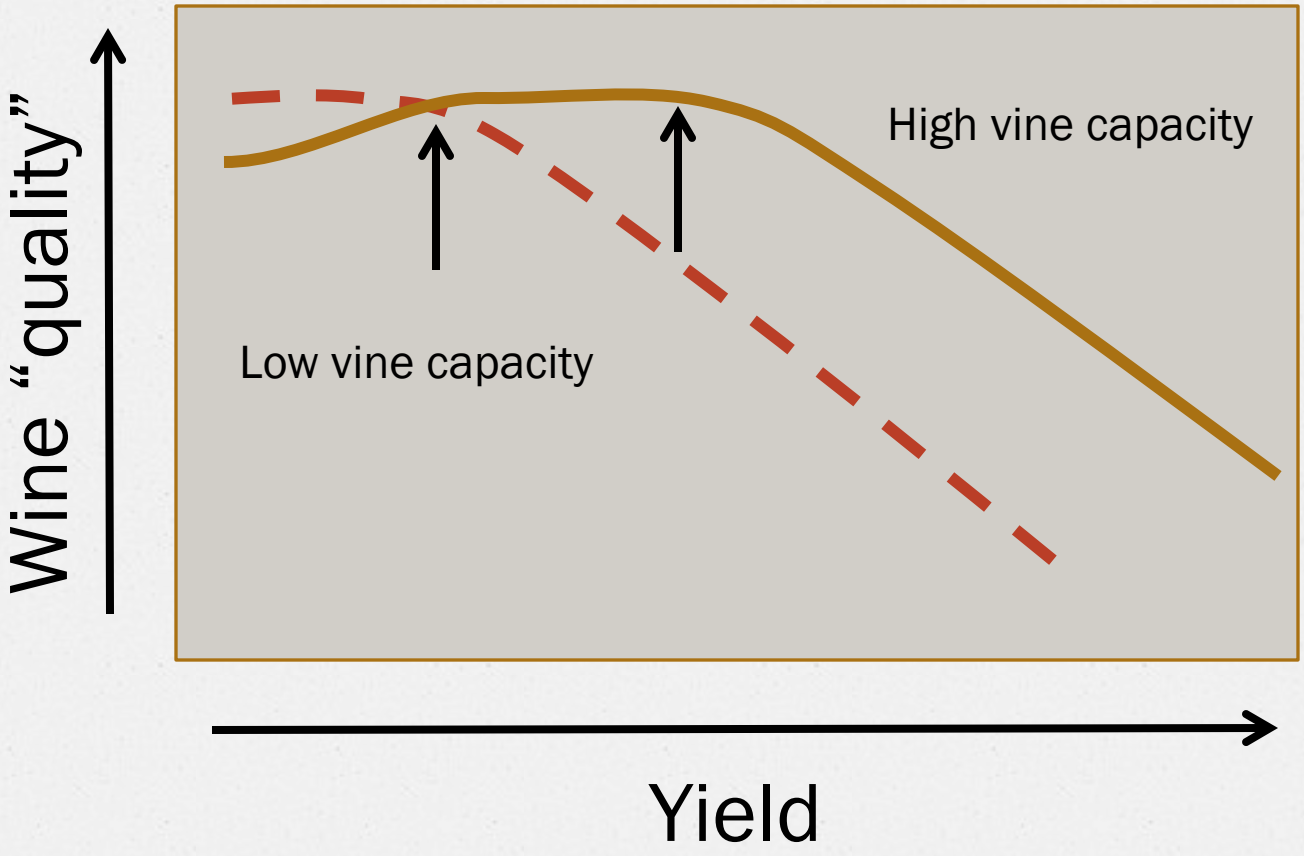

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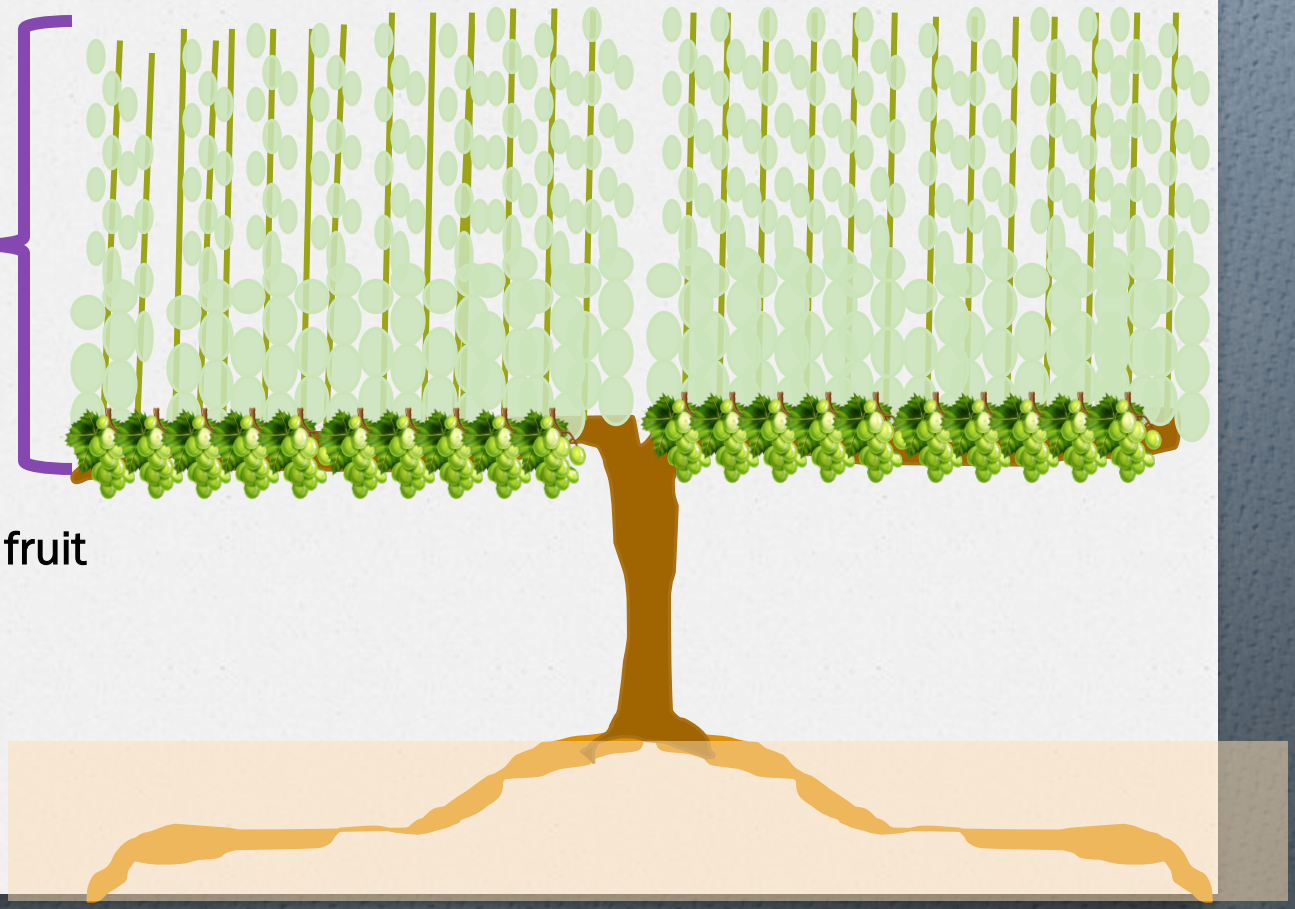

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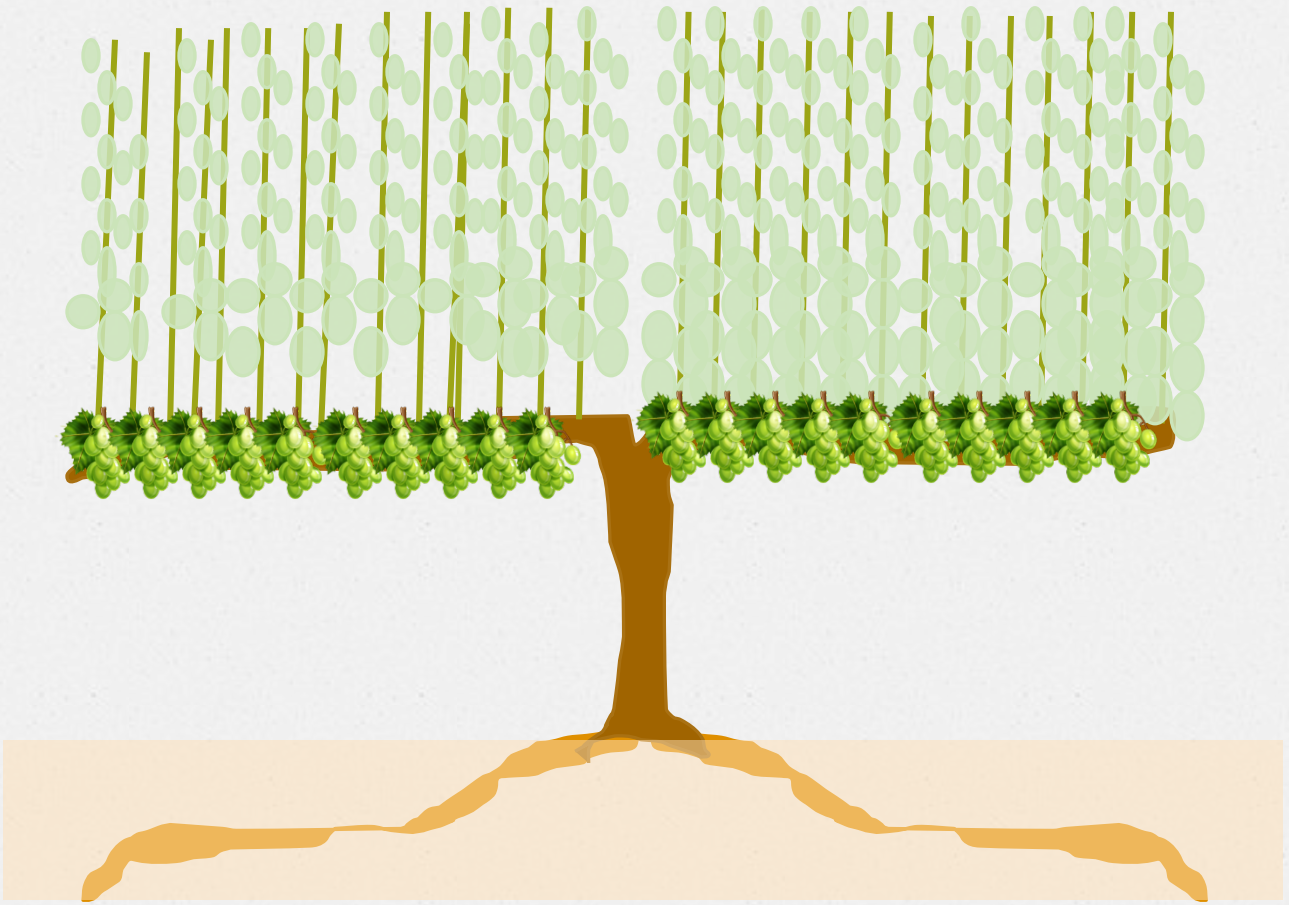

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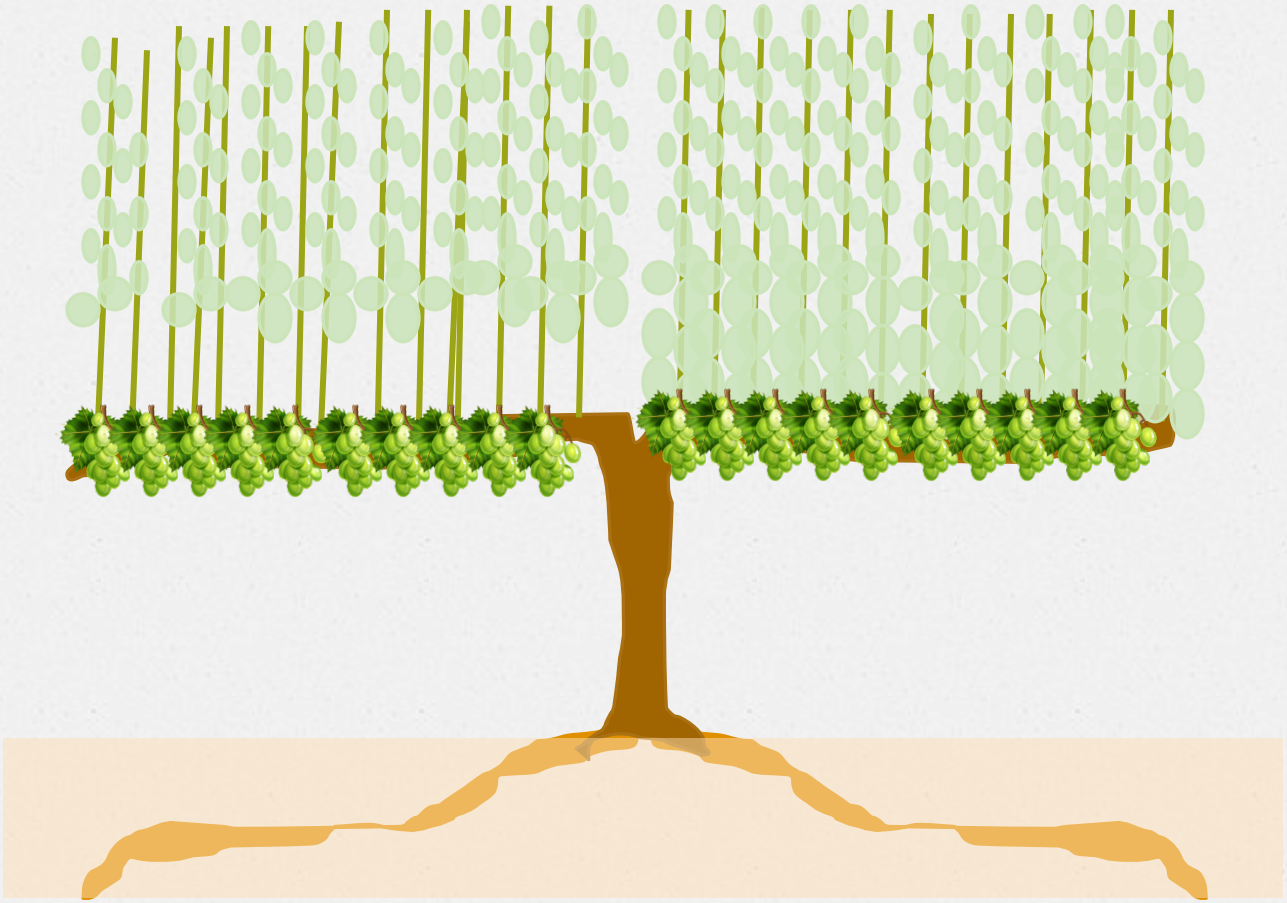

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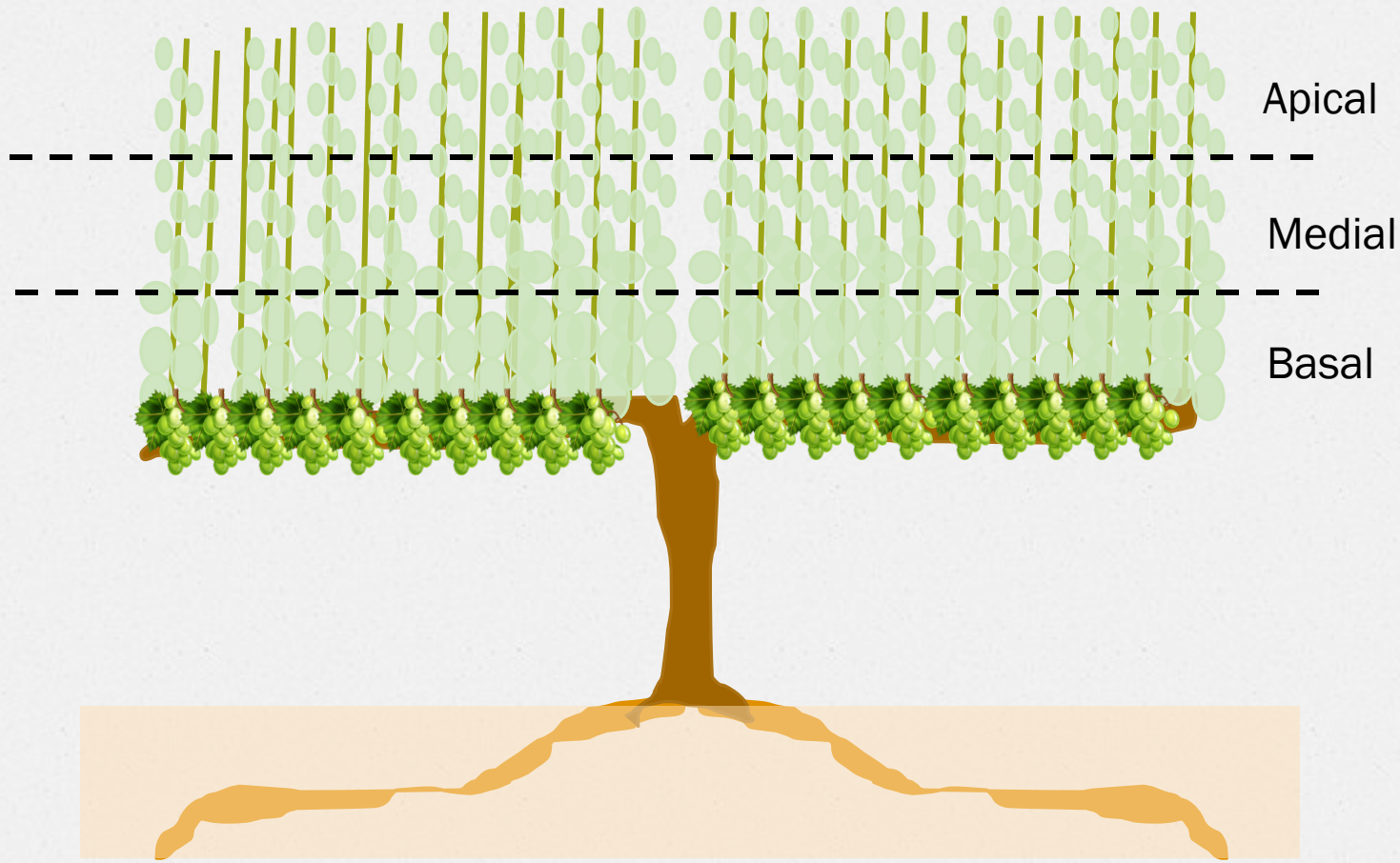

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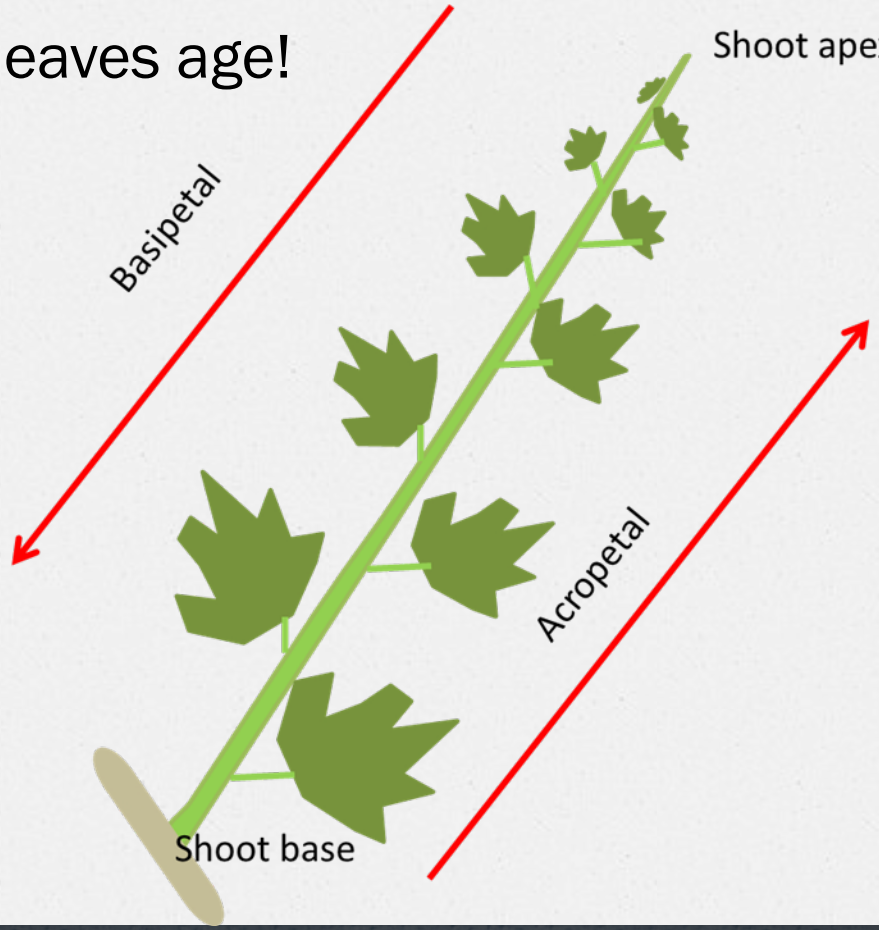

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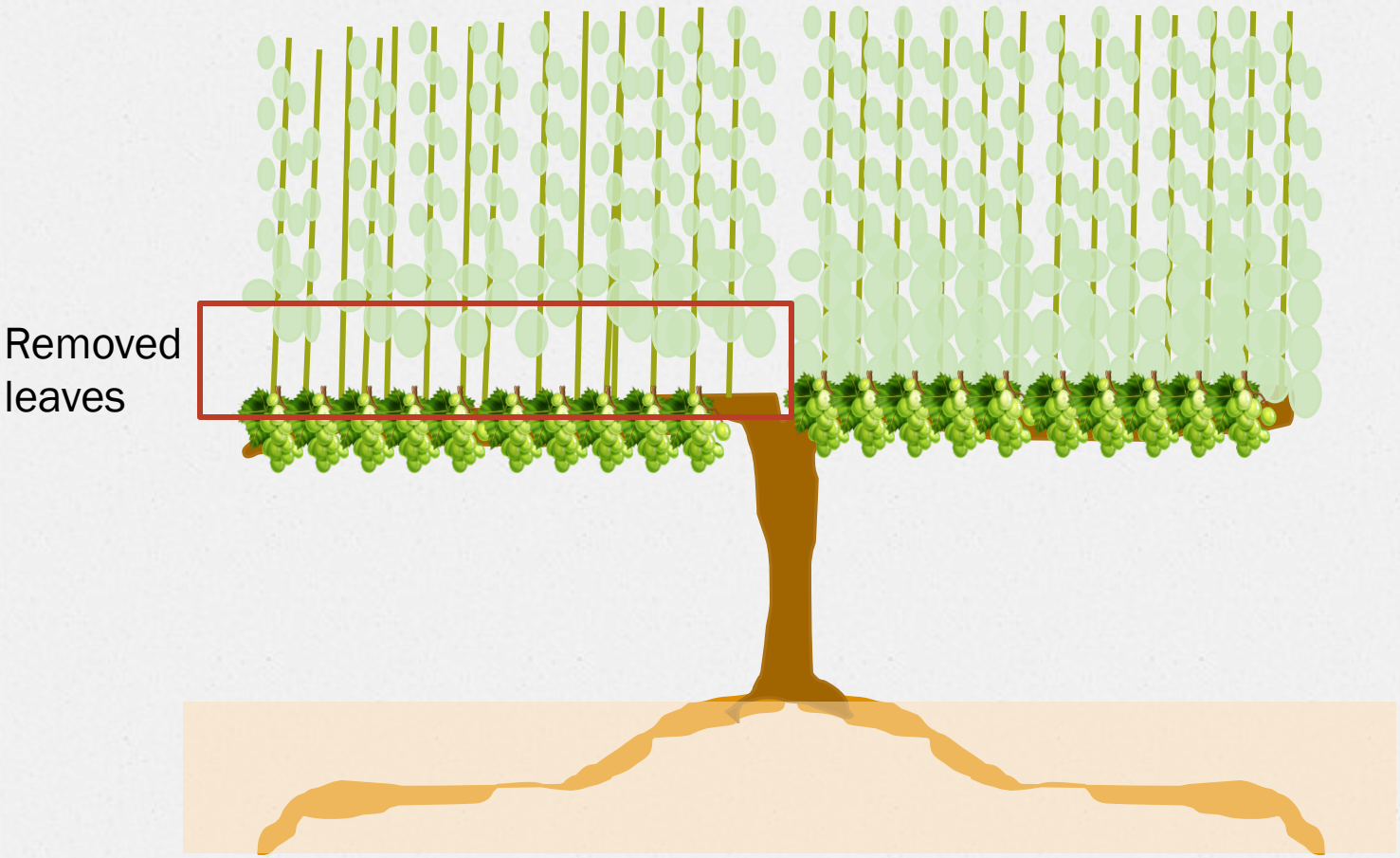

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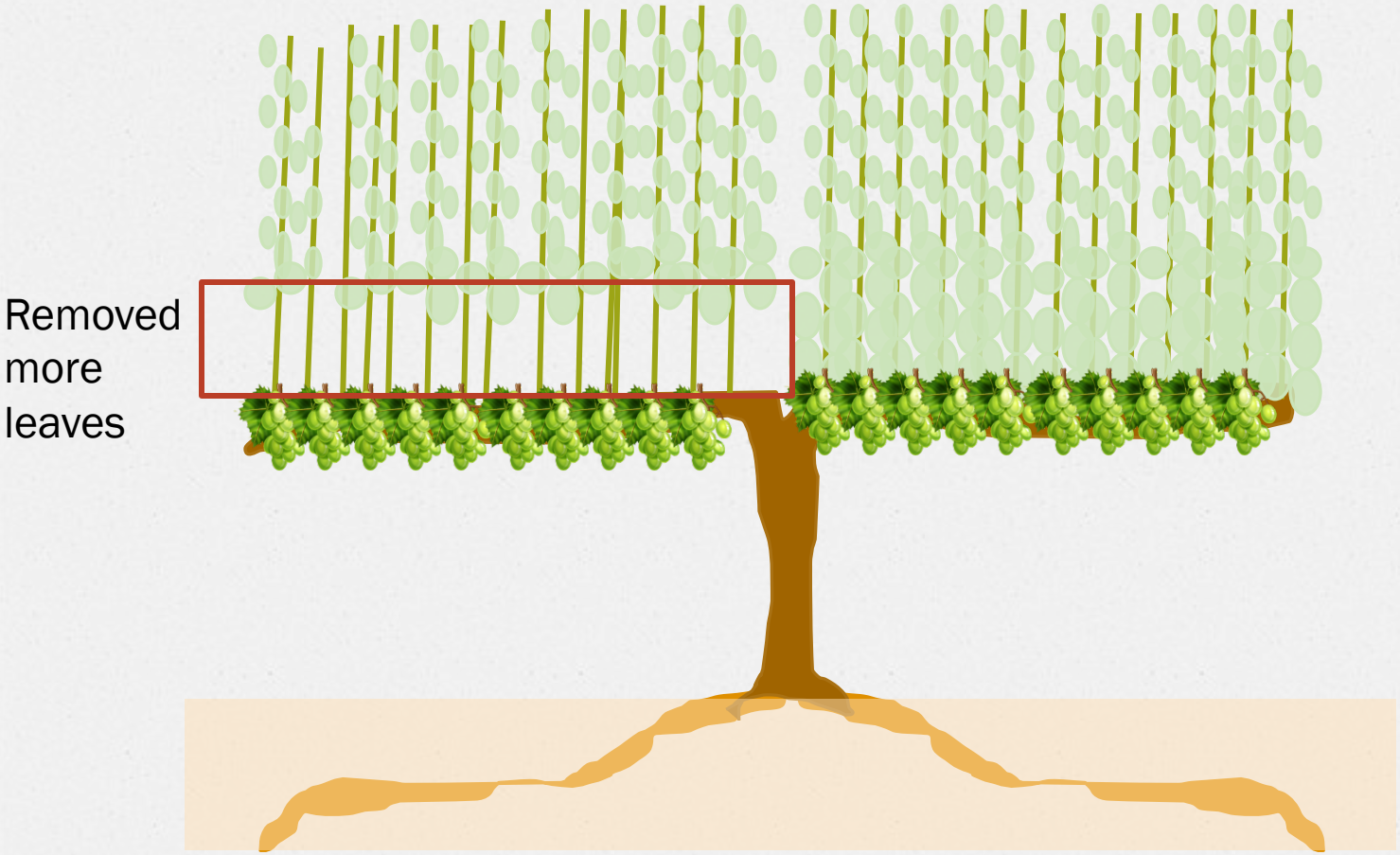

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Pre-plant considerations for vine size & balance management

Fritz Westover – Technical Program Manager – Vineyard Team, Atascadero, CA
fritz@vineyardteam.org

Site Considerations

- Soil fertility:
    - Organic Matter (1-3% is normal, >3% may indicate high nutrient availability),
    - Cation Exchange Capacity (greater CEC = greater nutrient availability)
    - Previous use of land and fertilization
- Water holding capacity of soil:
    - Internal drainage, texture (clay holds water), structure (contributes to drainage), depth of potential rooting (physical barrier–rock/hardpan or chemical barrier - pH)
- Precipitation:
    - Historical annual rainfall during growing season (April-November)

Variety and Rootstock Selection

- Vigor of variety:
    - e.g. Cabernet Sauvignon know for high vigor and persistent vegetative growth
- Vigor of rootstock:
    - soil and rainfall have greater influence, however rootstocks can be used to fine tune vigor goals
    - Consider need for irrigation of low vigor rootstocks during establishment and drought
    - Generally high vigor rootstocks: 1103P, 110R, 3309C, 5BB, 5C, Freedom, Harmony
    - Generally low to moderate vigor rootstocks: Riparia Gloire, 420A, 101-14,

Vine Planting Density

- Between rows should not exceed 1:1 ratio of canopy height to between row spacing
- In-row spacing most important decision (and most difficult to predict)
- Pruning and vine training methods must also be considered
    - Cane pruning necessitates closer spacing than spur pruned vines (≤ 5ft. for cane pruned vines)
- Vine to vine competition not reliable for vigor reduction (lack of data)
- Match in row vine spacing to soil, anticipated precipitation, variety and rootstock
- Planting density can vary across a block according to soil conditions (shallow vs. deep, clay vs. loam)

Vine Training System

- Choose a system that matches anticipated vine vigor
    - Choose system that matches variety (high wire or GDC an option for Norton or some hybrids with procumbent growth habit)

    - Design trellis height of VSP to allow adequate shoot length to ripen fruit and minimize hedging (distance from cordon to top of canopy – up to 4 feet of canopy height desired)
- If using low vigor system (e.g. VSP) design trellis specs to allow for modifications such as canopy division
    - Place VSP cordon wire at suitable height for vertical canopy division (38-42 inches above ground)
    - Allow appropriate spacing between rows for sprawling canopy such as Smart-Dyson Ballerina (≥8 ft. between rows)
- Design to allow mechanization of canopy manipulation when possible (hedging, trimming, cover crop management)

Pre-plant Considerations for vine size & vine balance

VINEYARD TEAM
Promoting Sustainable Winegrowing

Fritz Westover
Viticulturist
Technical Program Manager
fritz@vineyardteam.org

Site Considerations

Vineyard Establishment

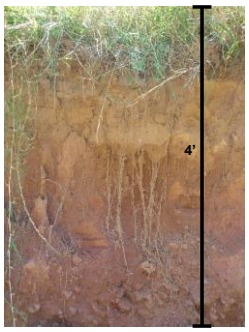
- Site preparation begins at least one year (better 2 or 3) prior to planting
  - Soil mapping & analysis, tillage, fertilization, cover crop establishment, variety and rootstock selection
  - Vineyard layout and design, trellis and training system

Sample soil of each block

- Map the block by soil type
- Sample blocks by soil type
- Sample multiple depths (A,B,C)

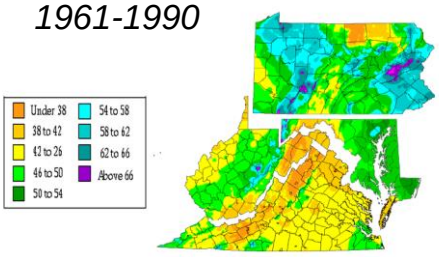
Soil Qualities & Potential Vigor

- Organic matter
  - 1-3% common
  - >3% may indicate high vigor
- Texture
  - % sand, silt, clay
- Structure
  - Roots
- Depth
- Rocks
- Previous land use



Average Annual Precipitation

1961-1990



Make Plans to Irrigate

- To adjust canopy vigor in dry years
- To deliver fertilizer with precision
- To compensate for de-vigoration practices by vineyard manager
- Possible to add a second line in blocks of mixed soil vigor.

Variety & Rootstock Selection

Grape Variety

Some varieties more prone to season long vegetative growth

Rootstocks

General High Vigor

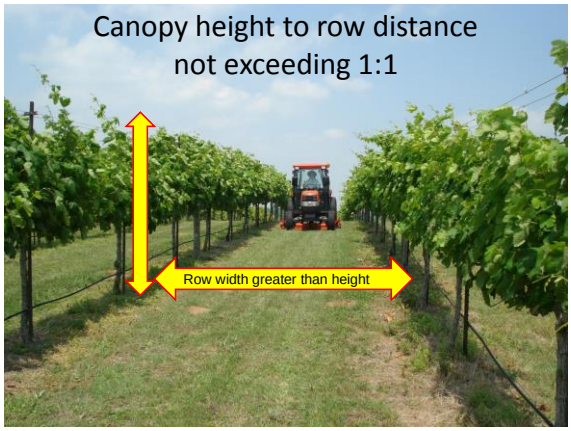
- 1103P, 110R, 3309C, 5BB, 5C

General Low Vigor

- 101-14
- 420-A
- Riparia Gloire

Decreasing vigor

Vine Planting Density

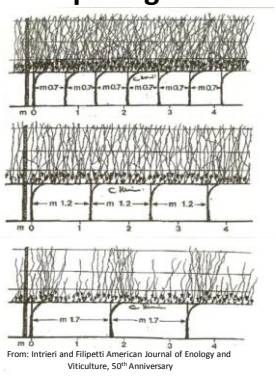


In-Row Vine Spacing

2'3" **Too Narrow**

3'11" **Optimum**

5'6" **Too Wide**



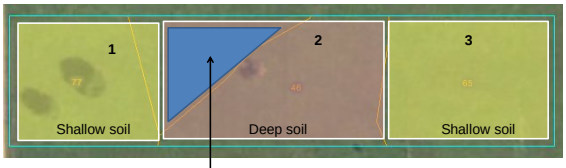
From: Intrieri and Filipetti American Journal of Enology and Viticulture, 50th Anniversary

Property Map (Web Soil Survey)

http://websoilsurvey.nrcs.usda.gov/app/HomePage.htm

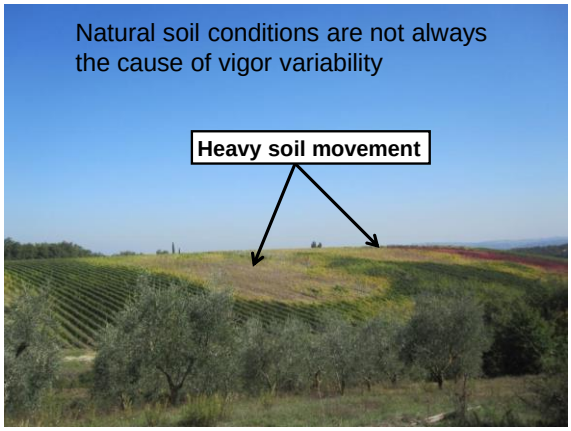
Soil Series of Block

Block Layout by Soil Type



Potential for different vine spacing within block to match soil

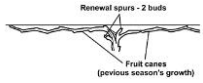
***Observations from previous vineyard are very useful if replanting on same site.**



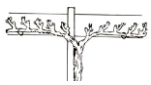
Vine Training System

Pruning Methods are Considered in Vineyard Design

- Cane pruned vines will require closer spacing to improve shoot uniformity
  - ≤5ft between vines for cane pruning



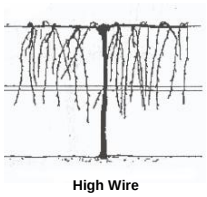
Cane Pruned Vine


Spur Pruned Vine

*Choose lower vigor rootstocks if planting vines with close in-row spacing

Non-Divided Canopy

•More "traditional" or "mainstream" training systems



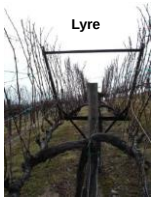
High Wire

Divided Canopies

Geneva Double Curtain

GDC

Lyre



Smart-Dyson

Bi-lateral cordon, vertical shoot positioned VSP

- An international standard
- Cordons at 30 to 42 inches above the ground (min. 38" if planning to divide)
- One fruiting zone

Some Common Training Systems

Smart-Dyson

"Ballerina"

Modified Training Systems

Southern/Western Sprawl

V-Trellis

Modified Training Systems

Sprawl

Southern/Western Sprawl

Southern/Western Smart-Dyson

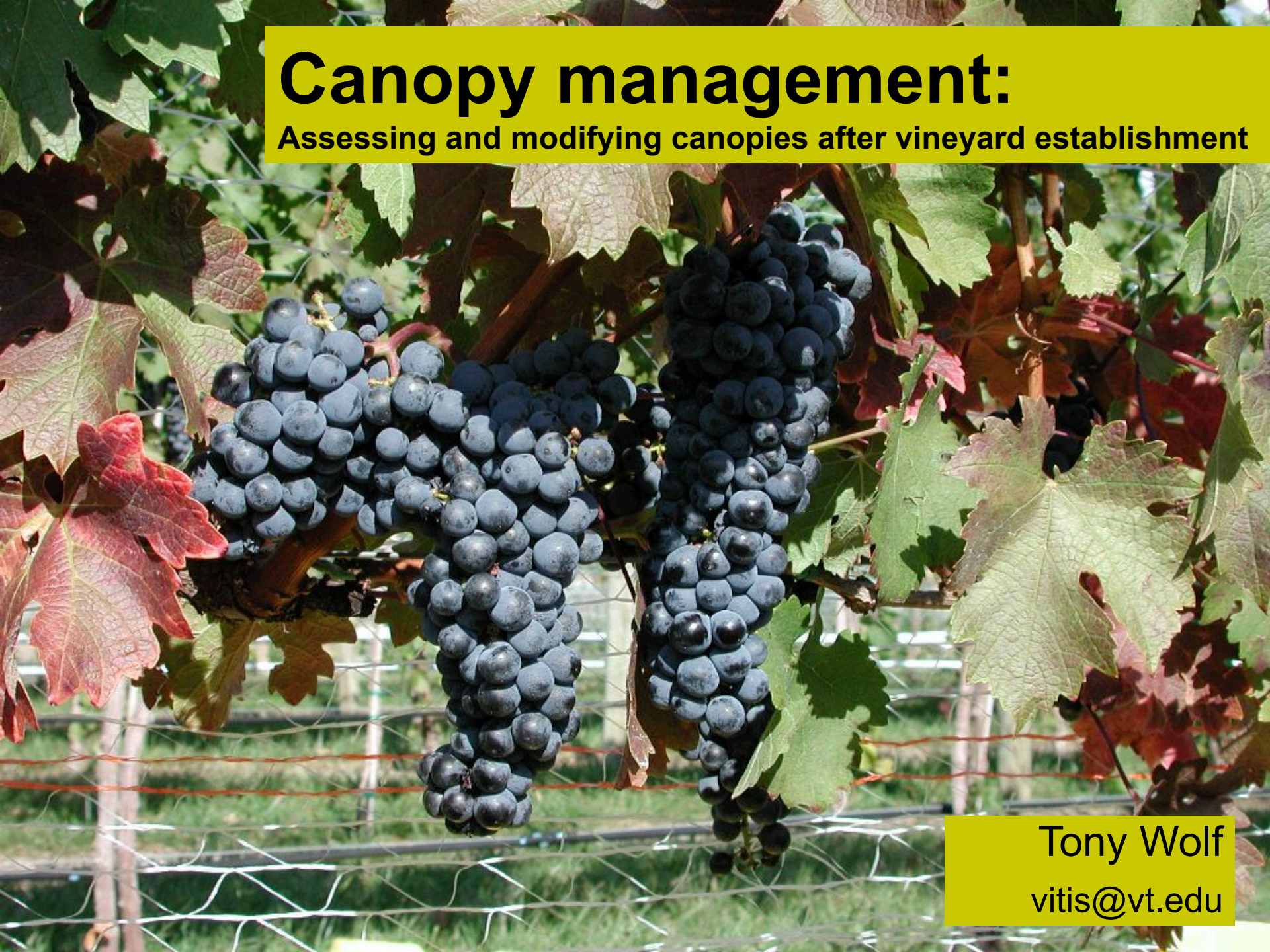
David Dorokowsky & Scott Thompson
R.H. Phillips, CA

Making the Conversion to Vertical Canopy Division

- Cordon on VSP must be no less than 38 inches from the ground (40 to 42 inches preferred)
- Must have vigor enough to support increased shoot number & yield
  - Dormant pruning wt 0.3 to 0.5 lb per linear ft. canopy
  - Average cane wt 30 to 40 grams per cane
- Must check fertility more closely
- Must have irrigation
- Check with your extension advisor & winemaker

Hedging

Other methods to combat seasonal or persistent high vigor?



Canopy management:

Assessing and modifying canopies after vineyard establishment

Tony Wolf
vitis@vt.edu

Presentation

I. Goals of canopy management
   - Disease management
   - Improved node fruitfulness and crop yield?
     - Probably more a function of pruning and basal node infertility with some varieties (e.g., SB, muscat)
   - Improved fruit composition
     - Primary
     - Secondary

   ⟹ Interaction with climate

II. Post-planting methods
   - Desired metrics: What is a “good canopy”?
   - Methods to achieve

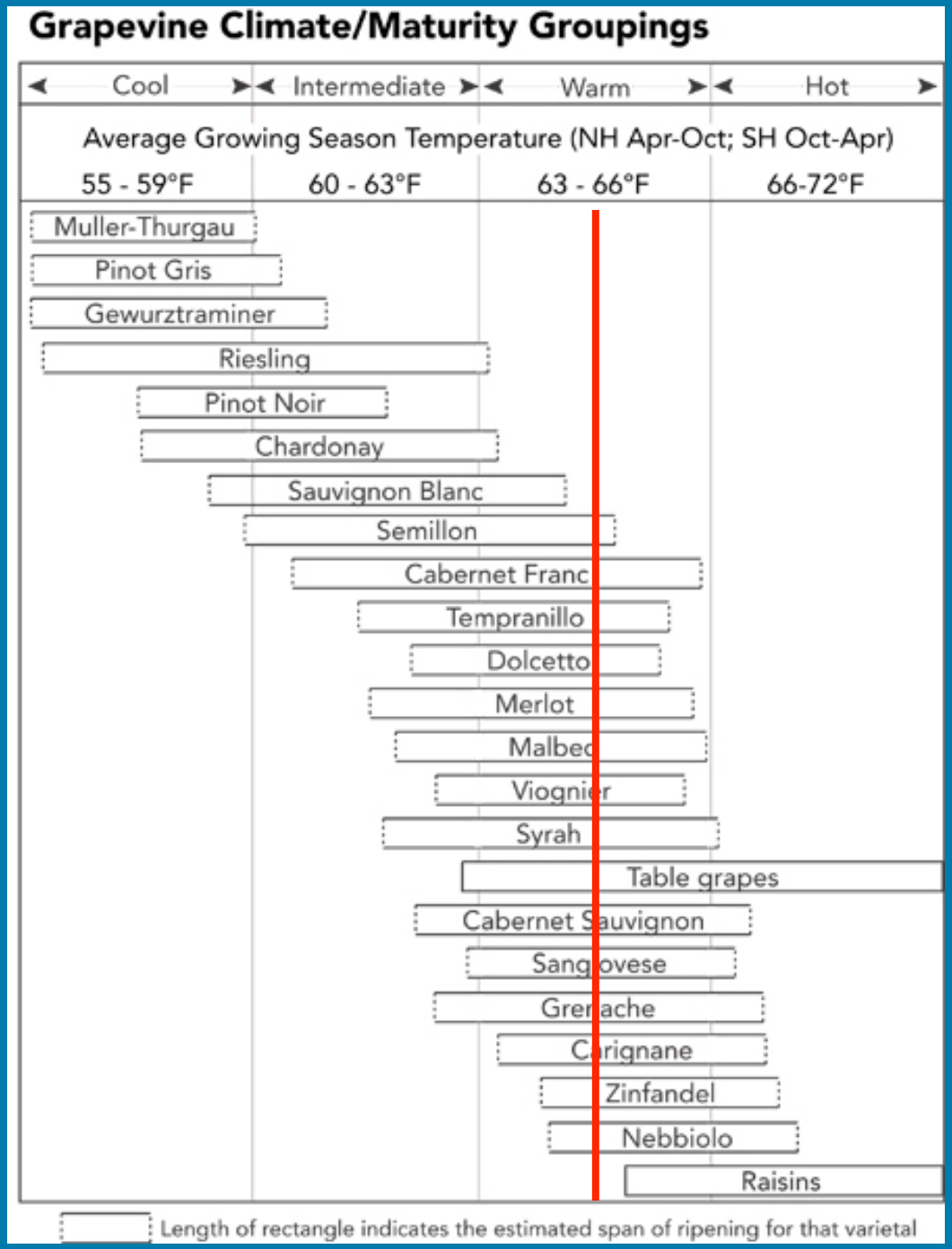
I. Goals of canopy management

- Disease management

Credit: eXtension (Fritz Westover)

I. Goals of canopy management

- Disease management
- Improved node fruitfulness
- Improved fruit composition
  - Primary
  - Secondary



Climate/Maturity groupings of Greg Jones (Southern Oregon University). It is based on the average growing season (Apr-Oct) temperature. Winchester, VA is about 65°F. MJT = 75°F (23.8C)

Insufficient heat:

- Unripe grapes; herbaceous character; elevated pyrazine levels, etc.

Excess heat:

- Cooked qualities; loss of aromatic flavor and aroma compounds, loss of color, excessive alcohol, etc.

Canopy management

Application of techniques which change the number and position of shoots and clusters in space to favorably affect canopy microclimate.

(adapted from Smart and Robinson, 1991, Sunlight into Wine)

Cluster exposure management

- warm/hot season goals vs. cool season goals?
- If a little cluster exposure is good, a lot must be even better?

Cluster exposure management

- warm/hot season goals vs. cool season goals?
- If a little cluster exposure is good, a lot must be even better?
- Excessive exposure can have negative consequences, especially with respect to secondary metabolites in berries

Cluster exposure management

- Excessive exposure:
  - Reduced pigments (e.g., anthocyanins)
  - Reductions in norisoprenoids
    - e.g., beta-damascenone (flowery, fruity); beta-ionone (violets)
  - Reductions in terpenoids
    - Riesling, Petit Manseng, Muscats

Cluster exposure management

- norisoprenoids:
  - Some cluster exposure pre-veraison for formation of precursors (carotenoids)
  - Cluster exposure post-veraison generally increases norisoprenoids in grapes and wine
    - However, it is not necessary to have high levels of exposure
    - Aim for moderate cluster shading, post-veraison

Exposure goals summary

	Warm / hot climate exposure goals	
	Leaves	Clusters†
Brix	Well exposed	Low/moderate
Anthocyanins	Well exposed	Low/moderate
Skin phenolics	Well exposed	Moderate
Norisoprenoids	Well exposed	Moderate
Terpenes	Well exposed	Moderate
Methoxypyrazines	Well exposed	Moderate/high††

† Moderate equates to one leaf layer, with a dappled sunlight exposure; little or no afternoon, direct sunlight

†† But pre-veraison exposure is more important than post-veraison (depends on variety – e.g., Sauv blanc – minimal cluster exposure)

Canopy management

height, width, length

shoot density

leaf layers

leaf area

Vine balance

Directly influence:

Microclimate

Sunlight penetration

Indirectly influence:

Fruit composition

Disease incidence

The “balanced” vine

- Ratio of crop weight to pruning weight is about 5 to 10
- Ratio of leaf area to fruit weight is about 12 cm^2 per gram of crop. This works out to about 12 to 17 leaves per 1.5 clusters of grapes, where clusters range from 150 to 200 grams (0.30 to 0.45 lb). We would like a steady-state condition at the onset of ripening (no need for further hedging)
- 3 to 4 shoots per foot of canopy
- About 1.5 leaf layers in the fruit zone, or one, on average, on either side of the canopy center line.

Canopy management

Canopy management in the East may occasionally need to address inadequacies of leaf area or vigor, but more often is aimed at correcting problems with excessive vegetative growth due to combination of fertile soils, rainfall, heat and nutrient availability.

Methods of canopy management

Direct: Methods that alter the arrangement of leaves and clusters

- Trellis system
- Dormant pruning (spur v. cane) and severity
- Summer pruning (hedging)
- Shoot thinning
- Shoot positioning
- Shoot, leaf and / or bunch removal

Methods of canopy management

Indirect: Methods that affect canopy density by reducing shoot vigor and/or the duration of shoot growth

- Irrigation management (works in a moisture-limited climate/environment)
- Crop level
- Cover cropping
- Root pruning?

A good canopy – two weeks post-bloom

A good canopy – veraison

Canopy assessment methods

- Visual scoring
  - Cluster exposure
  - Lateral development
  - Active shoot tips
  - Leaf size and color
- Quantitative measures
  - Point quadrat analysis
  - Light measures
  - Leaf area to fruit mass ratio measures

Target canopy characteristics for warm/hot regions such as Virginia, other Southeast US states

- post-bloom to veraison
- most red-fruited varieties*

Canopy feature	Optimal value or range
Canopy gaps	Not a very useful parameter
Leaf layers	1.0 to 1.5, on average; somewhat more on West; but requires either PQA or experience to assess
Shoot density	3 – 4 shoots per foot of canopy for VSP
Shoot length	12 to 20 fully unfolded leaves
Active shoot tips	5% or less by veraison
Cluster exposure	50% or more exposed on East side of canopy; less exposure on West side. Can further increase exposure for high-acidity varieties such as Norton
Lateral leaves in fruit zone	Few; say less than 10 leaves on basal 7 nodes of each shoot by veraison

- Aromatic whites could afford more cluster shading
- Norton (or other cvs. with high acidity) could benefit from more exposure

Insert slide of PQA measures

Representative canopy transect data summarizing the nature of contacts made with 50 canopy insertions of a probe.

Probe Insertion	Nature of contact*	Probe Insertion	Nature of contact	Probe Insertion	Nature of contact	Probe Insertion	Nature of contact	Probe Insertion	Nature of contact
1	LLFL	11	G	21	LL	31	F	41	L
2	LLL	12	LL	22	LLF	32	LL	42	G
3	FLL	13	FLLL	23	LFLL	33	FL	43	LF
4									LFL
5									LLL
6									LL
7									F
8	LL	18	LLL	28	LL	38	G	48	LF
9	F	19	FL	29	G	39	LFLL	49	LL
10	LL	20	LLL	30	LL	40	LLLF	50	LFL

85 Ls / 50 probes = 1.7 leaf layers

15 exterior fruit clusters/23 total contacts with fruit clusters (* 100) = 65% exterior clusters

Nature of probe contact: L = leaf, F = fruit cluster, and G = gap (no contact).
Contacts with shoot stems can be ignored.

Methods of canopy management

Indirect: Methods that affect canopy density by reducing shoot vigor and/or the duration of shoot growth

- Irrigation management (works in a moisture-limited climate/environment)
- Crop level
- Cover cropping (inter-row – conventional, but also moving into intra-row – esp. on steeper hillsides)
- Root manipulation (restricting and/or pruning) [Will discuss this more in the vineyard]

Methods of canopy management

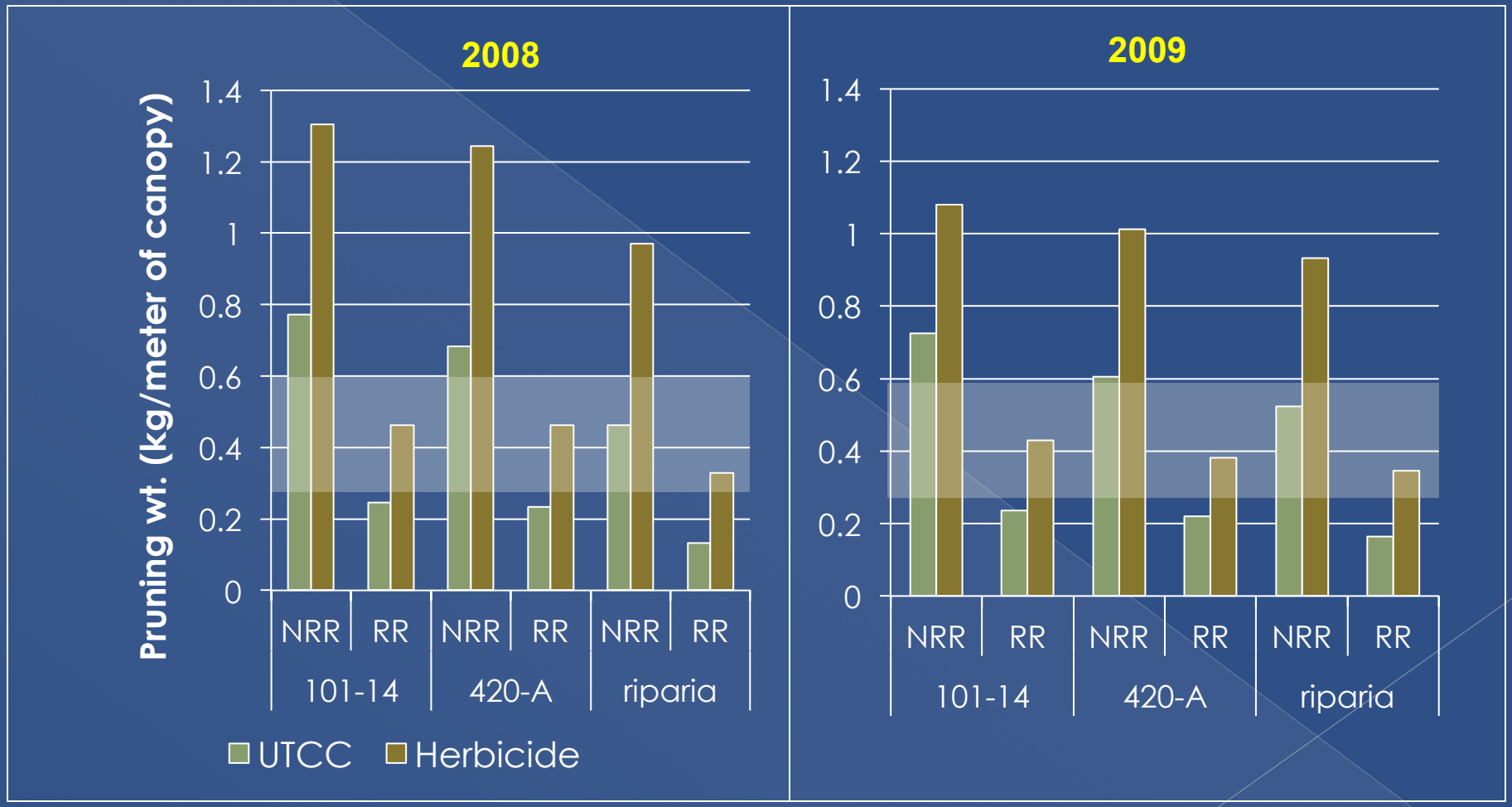
- Cover cropping
  - dial in the degree of competition desired

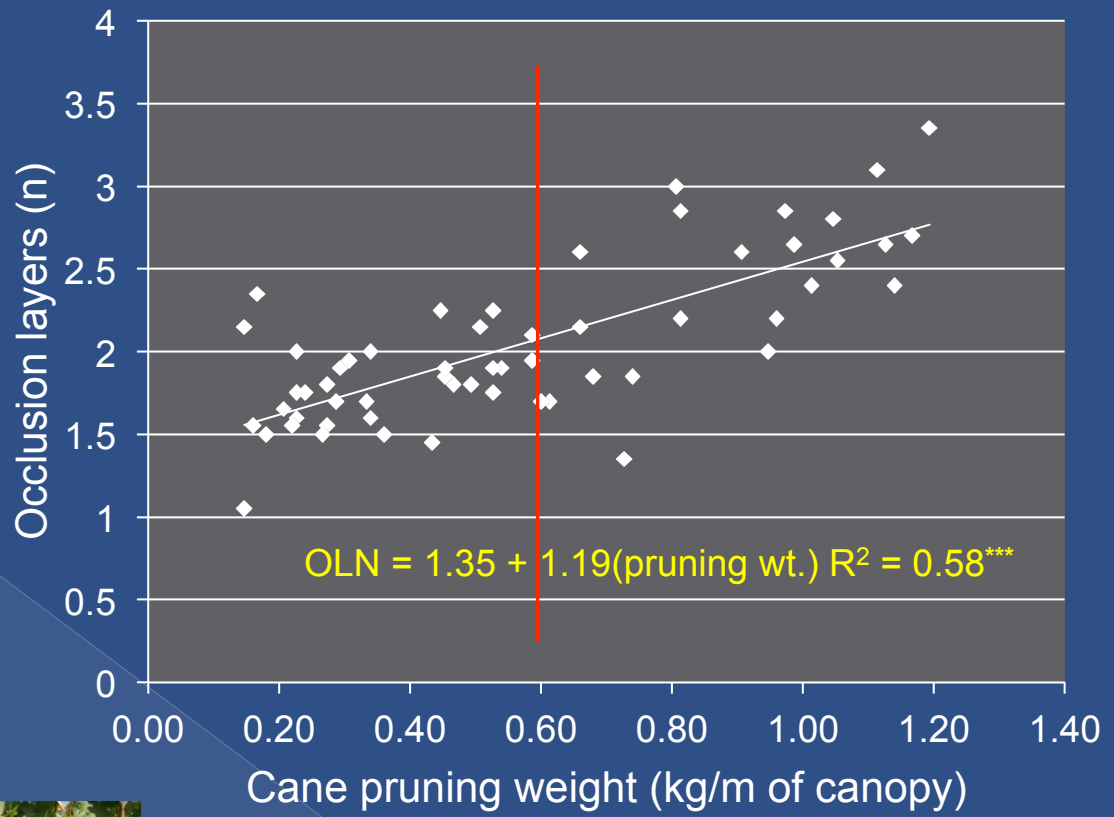
Data collection:

- Vines planted 2006; data collected since 2008
- Vegetative development (lateral growth, leaf area, canopy architecture)
- Plant water status
- Soil moisture
- Fruit components of yield and fruit chemistry

VirginiaTech
Invent the Future

Cane pruning weights were reduced by under-trellis cover crop (47%), riparia rootstock (25%) and by root restriction (> 50%).





When pruning weight exceeds 0.60 kg/m of canopy, the OLN (leaves) is generally in excess of 2 (about 1.5 is desirable).

Methods of canopy management

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- Shoot thinning
- Shoot positioning
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Shoot thinning

- Needs to be done early (soon after bud-break)
- More time-consuming with cordon-trained vines due to more base bud development
- Reduces yield, yes, but also reduces canopy density

Shoot positioning

- Integral to certain training systems: VSP, GDC, Smart-Dyson
- Timing and severity must be considered to avoid ill effects (e.g., shoot breakage, sun-burning of fruit)
- We all get caught out on occasion, but this seems to be a generally well followed practice

Shoot hedging

- Only after shoot positioning
- May not be required with downward shoot positioning (e.g., GDC)
- Leaves retained (15 – 17) more important than leaves removed
- Timing: beware potential for sunburning fruit

Excessive shoot hedging (lack of prior shoot positioning with high capacity vines)

Basal leaf and lateral shoot removal

- Removal of leaves and laterals from 1 to 3 nodes of fruit zone (IF NEEDED).
- Consider what other options can be used to manage shoot vigor, duration of shoot growth, and leaf layers
- *Disease management issues may override wine stylistic issues.*
  - Early leafing helps with powdery mildew and botrytis mgt and late leafing helps with botrytis and non-specific rots

Questions?