

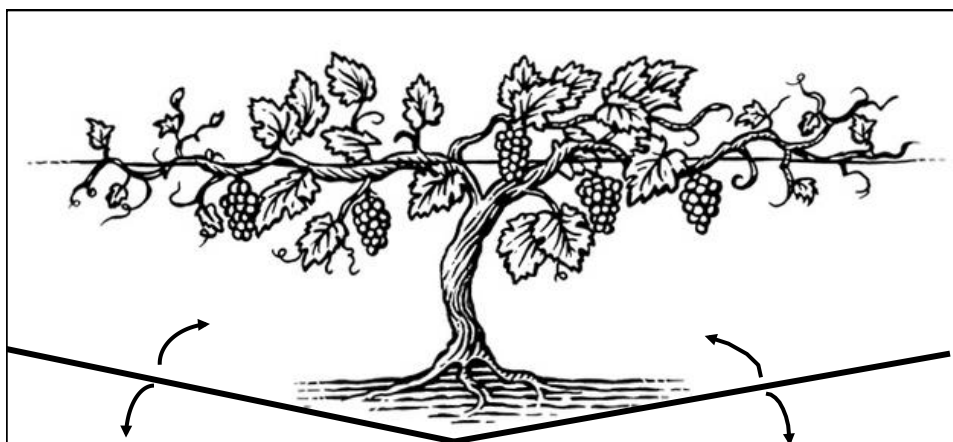
For personal use only



Finding Balance: Vine Size, Capacity, Vigor and Vine Balance

Alan N. Lakso

Mid-Atlantic Fruit and Vegetable Convention, January 2015



<http://grapesandwine.cals.cornell.edu/cals/grapesandwine/appellation-cornell/issue-13/vine-size.cfm>

Vine Size, Capacity, Vigor Crop Load and Balance

- Concepts of vine productivity and interactions of cropping and vegetative growth that affect grape and vine development and grape/wine quality.

First, some definitions....



What is Vine Size?

- **Vine size is the total VEGETATIVE growth of a vine.** Although it includes leaves and roots, we generally use winter pruning weight as the measure.



Mature cropping vines of moderate vigor (shoots 4-5 feet with 5 shoots/foot of trellis) will produce about 0.3-0.4 lbs pruning weight per foot of trellis.

What is Vine Capacity?

Vine Capacity is the TOTAL dry weight produced by both vine growth + crop).

Capacity is key to how much crop can be ripened



So, What is Vigor?

Vigor refers to the rate of shoot growth or final shoot length. Vigor is not vine size or capacity.

Note - two vines with 20 vs 40 shoots can have the same pruning weight (vine size) but different shoot vigor.



What is Crop Load?

Crop load is the relative balance of vine supply to crop demand.

- Both Supply and Demand must be considered.



**Vine
Capacity**

**Crop
Demand**



So Then, What is Vine Balance?

Proper vine balance occurs when the vine has a crop that is appropriate to the vine capacity and vegetative growth.

It is consistent with appropriate shoot growth to crop level that supports full ripening to desired quality and good return fruitfulness.

Generally want about 5 lbs of crop per lb of pruning weight. Example – at 6x10' spacing, with 2 lbs of pruning weight, 10 lbs of fruit giving about 3.6 tons/acre.

Vines of different sizes can all be balanced.

Vine Capacity

Vegetative Growth
(Vine Size)



Crop Growth
(Crop or Yield)



“Crop Load”
(Vine Balance is the
Right Crop Load)

Key Principles (Assuming Healthy Vines)

Vine Capacity depends on light energy interception,
so vines that intercept more light can ripen more crop.



Sparse Canopies
Low Capacity

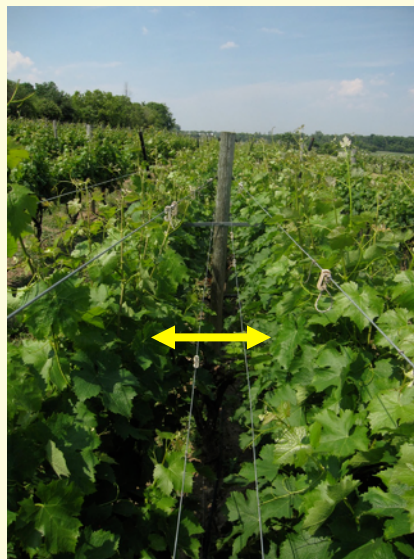


Solid Canopies
Higher capacity

Divided Canopies Capture More Sun and Can Ripen More Crop



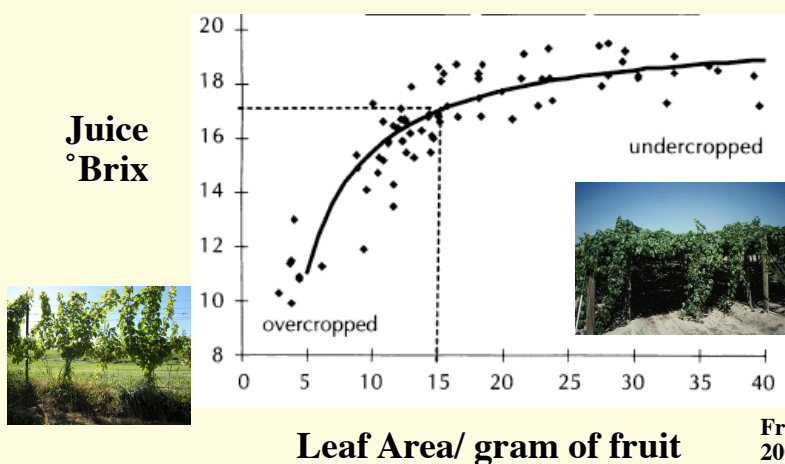
Scott Henry - Vertically divided



Lyre – Horizontally-divided

Key Principles (Assuming Healthy Vines)

It requires about 12-15 cm² of **exposed** leaf area to ripen a gram of fruit (more will not help much if any).



**Divided Lyre System Can Ripen More Fruit than VSP.
Same leaf area captures more sunlight in Lyre.**

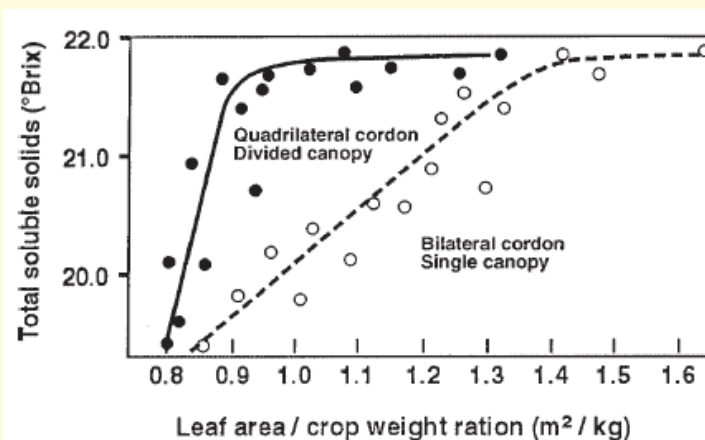
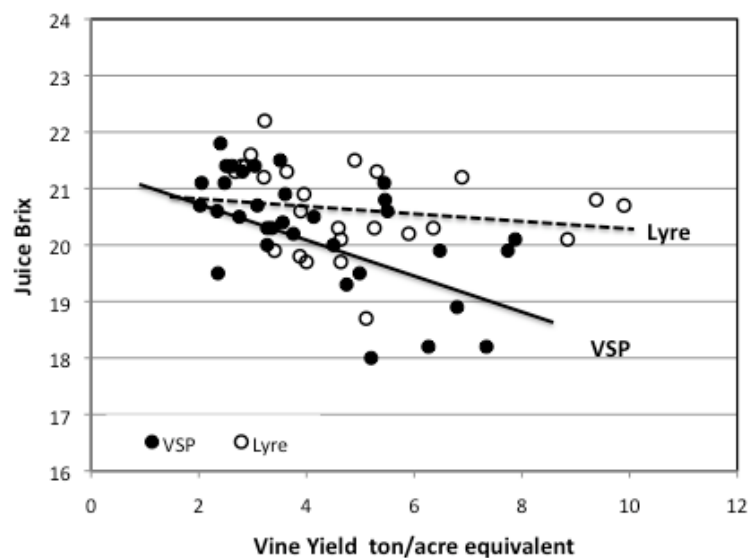


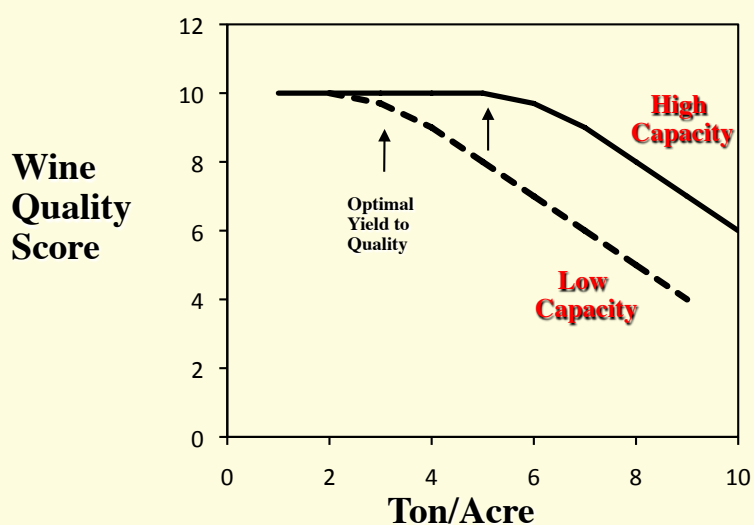
Figure 14 Regressions of total soluble solids (Brix) of Cabernet Sauvignon berry juice at harvest on leaf area per unit crop weight (m²/kg) of vines trained to either single-canopy or divided-canopy systems.

Kliewer & Dokoozlian 2005

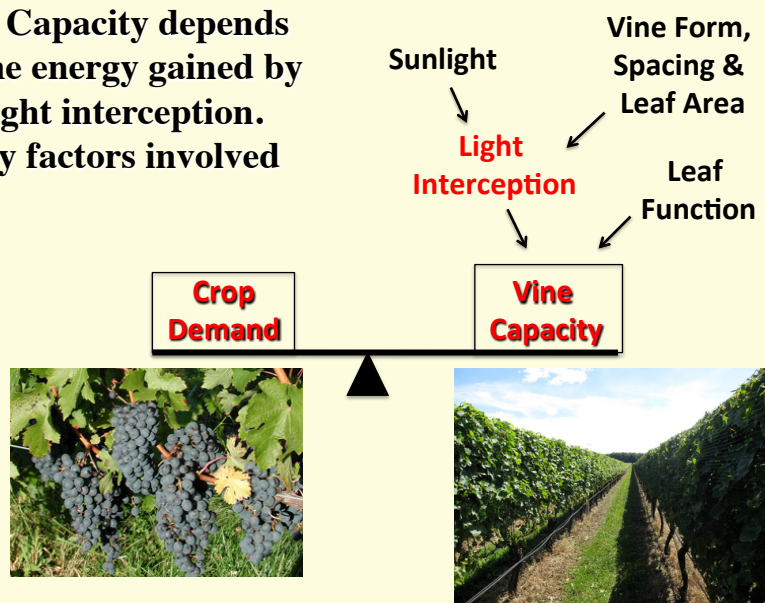
**Cabernet Franc 2011 Crop Load and
VSP vs Lyre Training Systems – Geneva, NY**

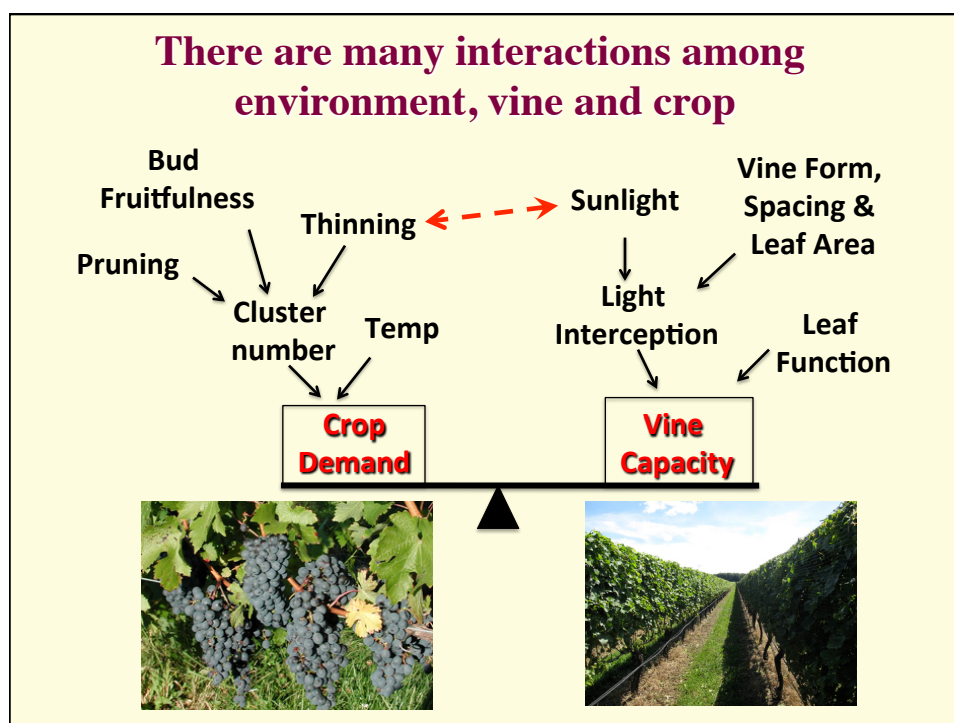
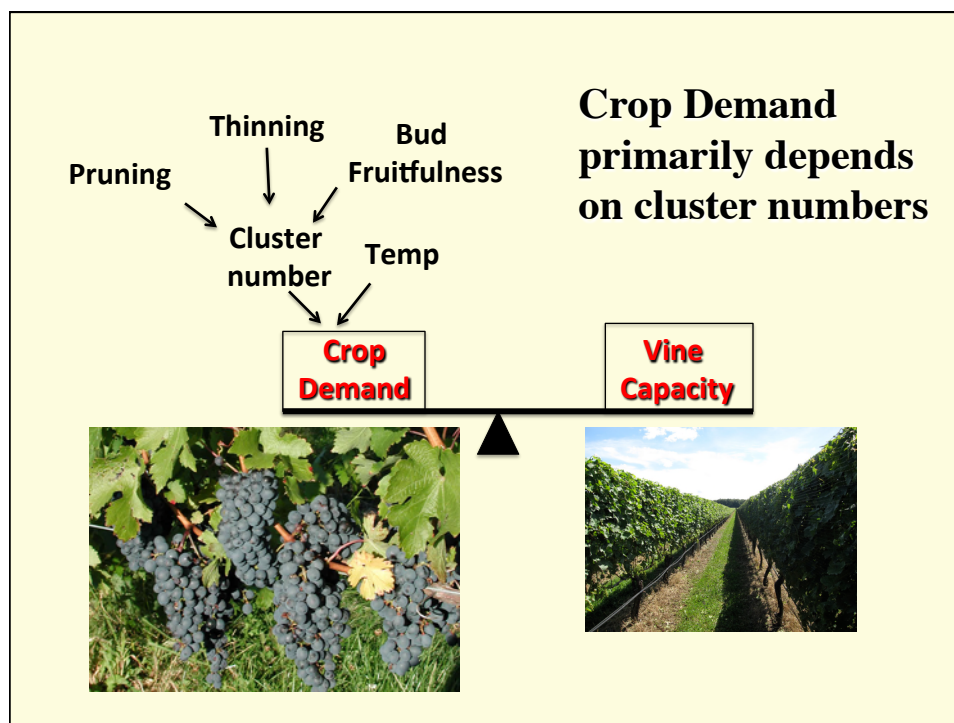


General Relationship of Wine Quality to Yield For Vineyards of Different Capacity

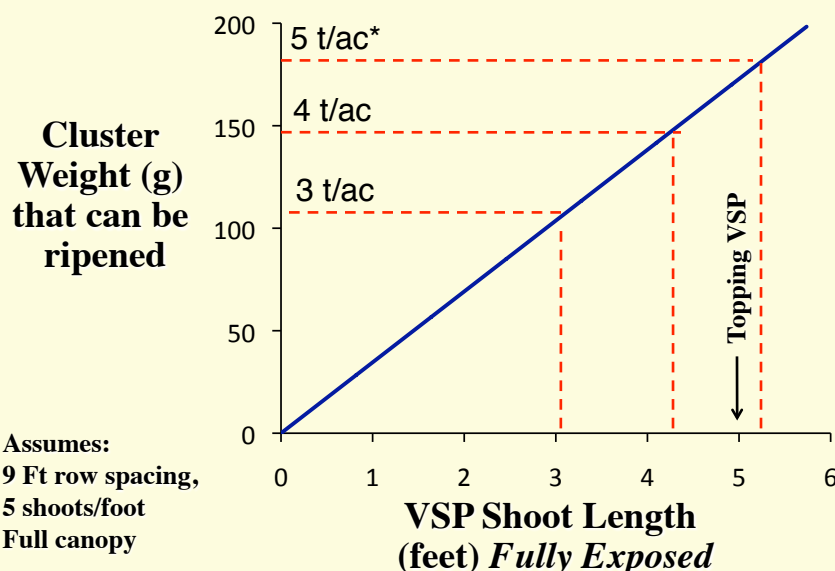


Vine Capacity depends on the energy gained by sunlight interception. Many factors involved





If 15 cm² leaf area needed, how much shoot length is needed to ripen different crops?



If you have a *healthy* VSP, with full canopy (few or no gaps) and normal spacing of 8-9 feet between rows:

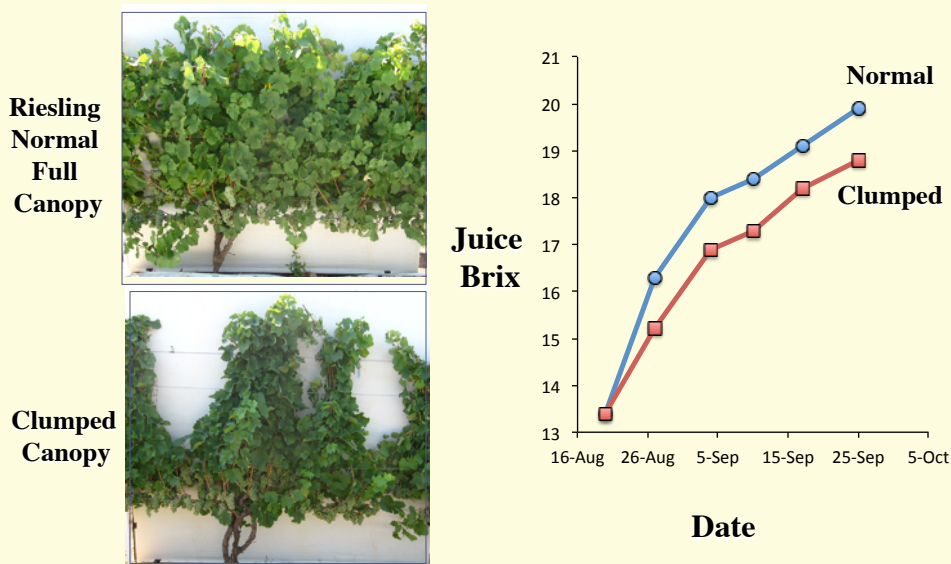
- **Rule of Thumb - For every foot of canopy height, you can ripen about 1 ton/acre.**

So, a common VSP with full 4 feet of canopy can ripen about 4 tons/acre

Commercial Vineyard
 in NY, 6 feet of
 canopy ripens 6 tons/
 acre of award-winning
 Riesling

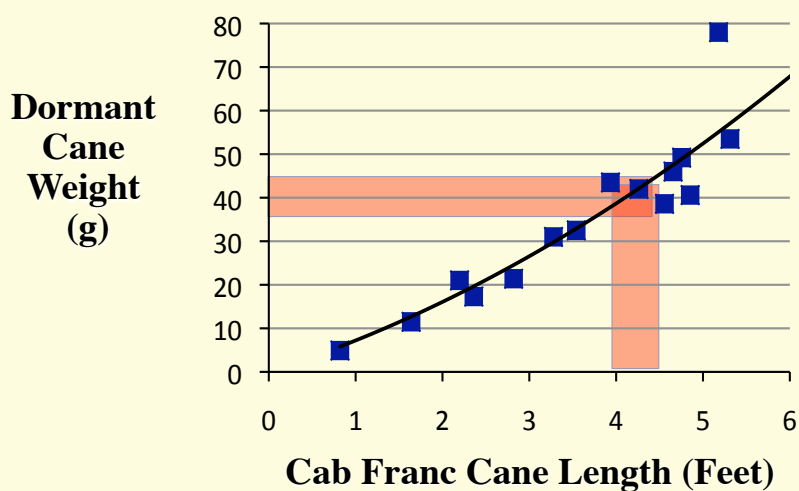


What about canopies that are not full?
 Just after veraison, some canopies were clumped to
 examine effects of different light interception on ripening.



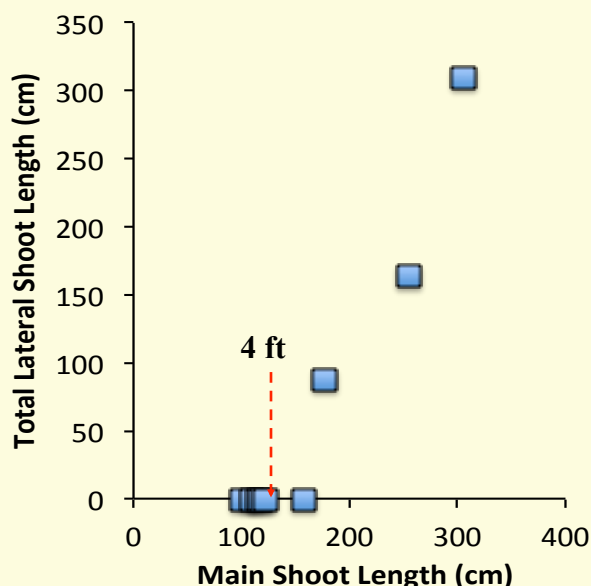
**“Ideal” shoot is about 4 feet long which gives a
 pruning weight of individual shoots of about 40 grams**

Basically, the goal is to just fill the trellis.



Ideal 4 ft shoots have relatively few lateral shoots, so canopy is not too dense.

Also ideal shoots normally are the desirable diameter and bud spacing for cane pruning.



Canopy Management is Easier in Balanced Vines with Moderate Shoot Vigor

- **Light distribution in the canopy affects other important processes. Light exposure in fruiting zone is key for:**
 - Flower bud development *in basal nodes* kept after pruning for next year's crop (i.e. sustainability); light needed bloom-veraison
 - Cluster light exposure -> red color (anthocyanins and phenolics - generally related to higher wine quality.
 - Cluster temperature - reduces acidity (mostly malic acid) levels and affects secondary metabolites positively and negatively.
 - Winter hardiness – better exposure and moderate vigor improves hardiness.

Balanced vines have less canopy density so less leaf and lateral removal required, and much less topping needed.

How Do You Get to Balance If You Are Out of Balance?



Approaches to Dealing with Weak Growth

Accept small vine, thin to small crop – difficult to know how much crop to leave; requires significant thinning labor.

Leave fewer shoots to increase remaining ones growth.

Improve vine growth to support normal crop – improve growth by improving water and/or nutrients, improve soil



Approaches to Controlling Excessive Growth

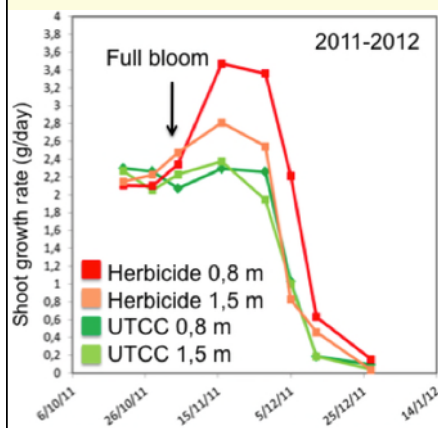
External Competition

Reducing growth to *limit the vine capacity*, i.e. total growth of the vine.

This is done by *limiting external resources*: water, nutrients, or via rootstocks (partial control). Includes regulating irrigation if possible, reducing fertility, competition with cover crops, etc.



In a shallow soil, under-trellis cover crops can reduce excess shoot vigor.



Courtesy A. Coniberti

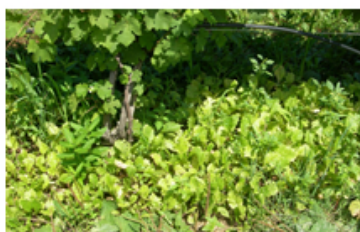
Current research on under-vine cover cropping and root pruning to control excessive growth.



Root pruning



Buckwheat



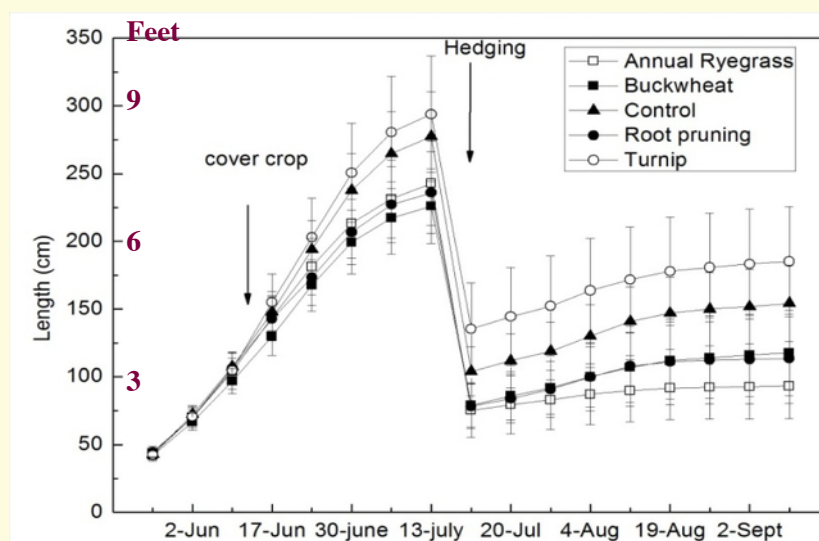
Turnip



Annual Ryegrass

Courtesy J. Vanden Heuvel et al

Under-vine cover cropping effects on Cab franc shoot growth. Difficult to control growth if have deep rich high WHC soils.



Courtesy J. Vanden Heuvel et al

Approaches to Controlling Excessive Growth

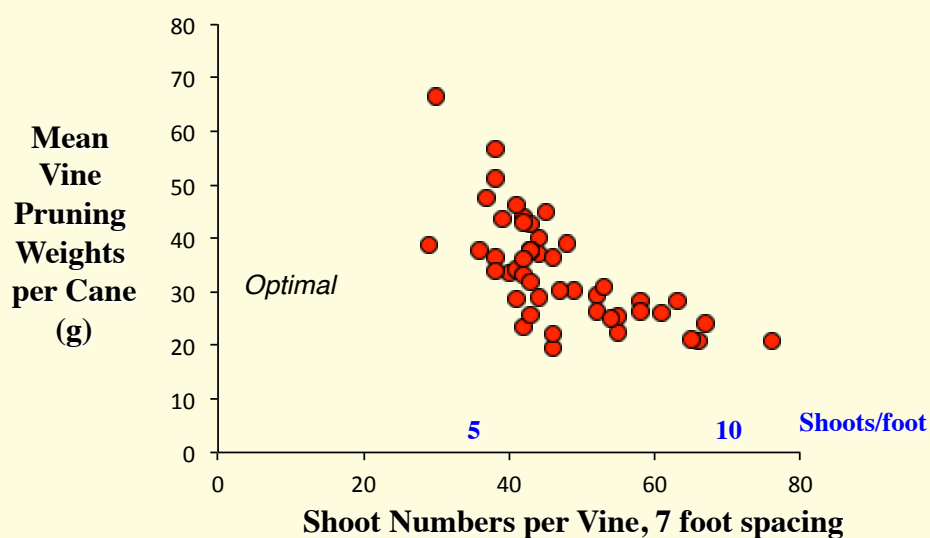
Internal Competition

Controlling Shoot Vigor by Increasing Shoot Numbers - within any vine size leaving the appropriate numbers of shoots to provide *internal competition* to reduce shoot vigor (Balanced Pruning).

In large vine sizes this may require canopy division to accommodate the extra shoots, and cluster thinning to balance crop.



Shoot Vigor (as mean pruning weight per cane) in a vineyard depends on the number of shoots/vine.



Cab franc 2012

VSP After Leaf Fall **40 shoots/ 7 ft vine**

**Excess vigor in
general but also
great shoot variability**

**Difficult to judge
thinning with such
shoot variability**



Lyre Vines After Leaf Fall 2012

**Leaving 18 shoots/lb pruning weight controlled vigor of shoots,
and switch to spur-pruned cordons helped uniformity**



Summary of Key Points

- **Vine Capacity depends on light interception and will determine potential crop that can be ripened.**
- **Crop Load will determine the actual growth and ripening. Optimum values of crop/pruning weight are generally 5-10.**
- **Balance can be achieved at different absolute crop and pruning weights.**
- **Balance in vines with excessive vigor can be reached by reducing vine capacity by competition with same crop or utilizing it with higher shoot numbers, higher crops and divided canopies if necessary.**

Thanks and Have a Vintage Year!



<http://grapesandwine.cals.cornell.edu/cals/grapesandwine/appellation-cornell/issue-13/vine-size.cfm>