Integrated Canopy Management of Vineyards

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Grapevine Carbohydrate Dynamics- Source/Sink Relationships

- Source-
  - Photosynthesis
    - Water
    - Nutrients
    - Light
    - Freedom From Biotic & Abiotic Stresses
- Sink
  - Shoots (Leaves, Petioles & Stems)
  - Developing Fruit
  - Roots
  - Extended Woody Trunk

Concepts in Canopy Management

- Balanced Vines
  - Achieving a Balance Between Vegetative Growth and Reproductive Growth (Fruit Production)
  - Produce Enough Vegetation to Optimally Ripen the Crop, Mature the Next Year's Fruiting Wood and Store Sufficient Carbohydrates to Support the Next Season's Initial Growth and Maximize Winter Hardiness

Site & Soils

- Deep Fertile Soils With Abundant Water Holding Capacity Are at the Highest Risk of Growing Excessively Vigorous Vines
- Shallow Rocky Soils May Provide Insufficient Rooting Depth And Limited Water & Nutrient Holding Capabilities and Vines May Struggle to Have Sufficient Vigor

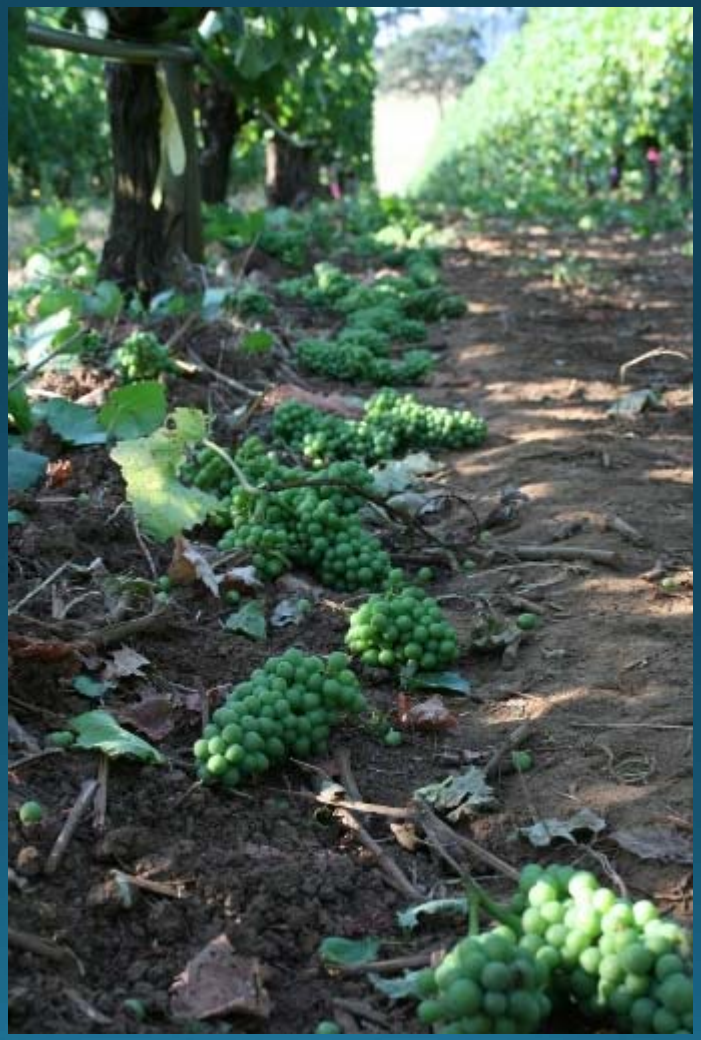
Achieving That Balance Starts With Site Selection

- Understanding the Inherent Vigor of Sites Will Impact
  - Variety Selection
  - Rootstock Selection
  - Vine Spacing

Rootstock	Synonym	Parentage	Vigor
Riparia Gloire	Gloire de Montpellier	V. riparia	Low/ Moderate
Saint George	Rupestris du Lot	V. rupestris	Very High
1616 Couderc	1616C	V. solonis x V. riparia	Low
3309 Couderc	3309C	V. riparia x V. rupestris	Moderate/ High
44-53 Malegue	44-53M	V. riparia x 144M	Moderate
101-14 Millardet Et De Grasset	101-14 Mgt.	V. riparia x V. rupestris	Low/ Moderate
Swarzmann	Swarzmann	V. riparia x V. rupestris	Low/ Moderate
41B Millardet Et De Grasset	41B	V. berlandieri x V. vinifera	
420A Millardet Et De Grasset	420A	V. berlandieri x V. riparia	Low
Oppenheim #4	SO4	V. berlandieri x V. riparia	Moderate
5BB Kober	5BB	V. berlandieri x V. riparia	Moderate
5C Teleki	5C	V. berlandieri x V. riparia	Moderate
1103 Paulsen	1103P	V. berlandieri x V. rupestris	High
RS-3	RS-3	Ramsey x Schwarzman	Low
RS-9	RS-9	Ramsey x Schwarzman	Medium
Kingfisher	PC01126-29	V. champinii x V. rufotomentosa x Riparia Gloire	High
Matador	PC0188-151	101-14 Mgt x (V. mustangensis x V. rupestris)	High
Minotaur	PC0188-32	101-14 Mgt x (V. mustangensis x V. rupestris	High
GRN-1	8909-05	V. Rupestris x Muscadinia	Moderate/ High
GRN-2	9363-16	V. rufotomentosa x V. Champinii	Low/ Moderate
GRN-3	9365-43	V. rufotomentosa x V. Champinii+	Moderate+
GRN-4	9365-85	V. rufotomentosa x V. Champinii+	Moderate/ High
GRN-5	9407-14	V. Champinii x V. Berlandieri x V. Riparia	High
110 Richter	110R	V. berlandieri x V. rupestris	High
140 Ruggeri	140Ru, Ru 140	V. berlandieri x V. rupestris	Very High
Freedom	Freedom	1613 C x V.champinii	High
Harmony	Harmony	1613 C x V. champinii	High
Ramsey	Salt Creek	V. champinii	Very High
VR 039-16	039-16	V. vinifera x V. rotundifolia	High

Tools For Managing Vine Vigor

- Water
- Nitrogen
- Crop Load
- Competitive Vegetation?



Why Do We Prune?

We Prune To Limit Crop

Prune Too Much- Excessive Vegetative Growth
Reduced Winter Hardiness & Production Potential
Prune Too Little- Poor Fruit Quality, Nominal Vegetative Growth, Reduced Winter Hardiness & Productive Potential

Why Do We Prune?

We Prune To Invigorate Grapevines
Dormant Pruning Is An Invigorating Action
In Any Year, We Are Growing Two Crops

Why Do We Prune?

We Prune To Distribute A Canopy That Will Adequately Intercept Sunlight To Ripen A Crop

Estimating Vine Vigor & Capacity

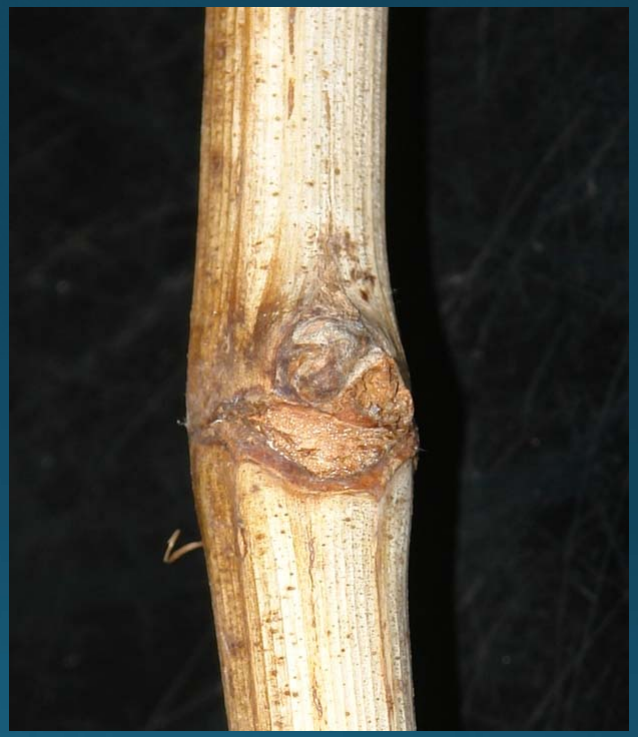
Pruning Weights In Excess of 0.4# of 1 Year
Old Prunings /Linear Foot of Row, Border on Excessive Vigor

The Three Components Of Grapevine Pruning

- Bud Number
- Bud Quality
- Bud Distribution

(Node) Bud Number

- The Fruit on Grapevines are Borne On Current Season's Growth
- Pruning is the Single Greatest Way Growers Control Crop Size
- Retained Node Number is a Function of Site, Variety & Target Maturity Indices



Bud Quality

- Proper Diameter
- Short Internode Length
- Well Exposed to Sun

Bud Distribution (Training System)

Excessive Vigor

- Vines Produce Large, Vigorous Shoots With Large Leaves, Long Internodes and Excessive Lateral Shoot Development
- Fruit Zone is Excessively Shaded Resulting in Inferior Fruit Quality With Exacerbated Powdery Mildew Pressure
- Shaded Fruit Zone Results in Poor Fruit Bud Development for Following Year's Crop
- Shaded Fruit Zone Creates Much Higher Disease Pressure for Late Season Rot Organisms
- Shaded Renewal Zone Results in Poor Periderm Formation and Increased Cold Susceptibility

When Do We Prune?

- How Many Vines Do You Have?
- How Much Money Are You Willing to Spend?
- Variety Pruning Order (last budbreak to first)

Insufficient Vigor

- Drought, Limiting Soils, Unmanaged Weed Competition, Disease Pressure, Insufficient Nutrients Can All Lead to a Sparse Canopy With Little or No Ability to Ripen a Crop
- Shoots & Fruit Compete for Carbohydrates, So Excessive Crop Load Can Also Lead to Insufficient Photosynthetic Capacity
- In Addition to Poor Fruit Maturity, Over-cropped Vines May Not Ripen Wood Sufficiently to Withstand Winter Temperatures.

Making Corrections to Achieve Balance

- Excessive Vigor
  - Reduce Water
  - Reduce Nitrogen
  - Set Heavier Crop Load, then Thin
  - Establish Divided Canopy
- Insufficient Vigor
  - Increase Nitrogen
  - Increase Water Amount
  - Improve Vineyard Floor Management
  - Set Less Crop

Sunlight Interception

- Primary Need is to Prevent Excessive Shading of Canopy
  - Leaves Produce Carbohydrates Through Photosynthesis Needed for Plant Growth and Fruit Maturity
  - Because They are Photosynthetically Inefficient, Shaded Leaves Compete With Fruit For Carbohydrates
  - Shaded Leaves May Contribute to Excessive Potassium Levels in Fruit Resulting in Elevated Must pH.

Shoot Density

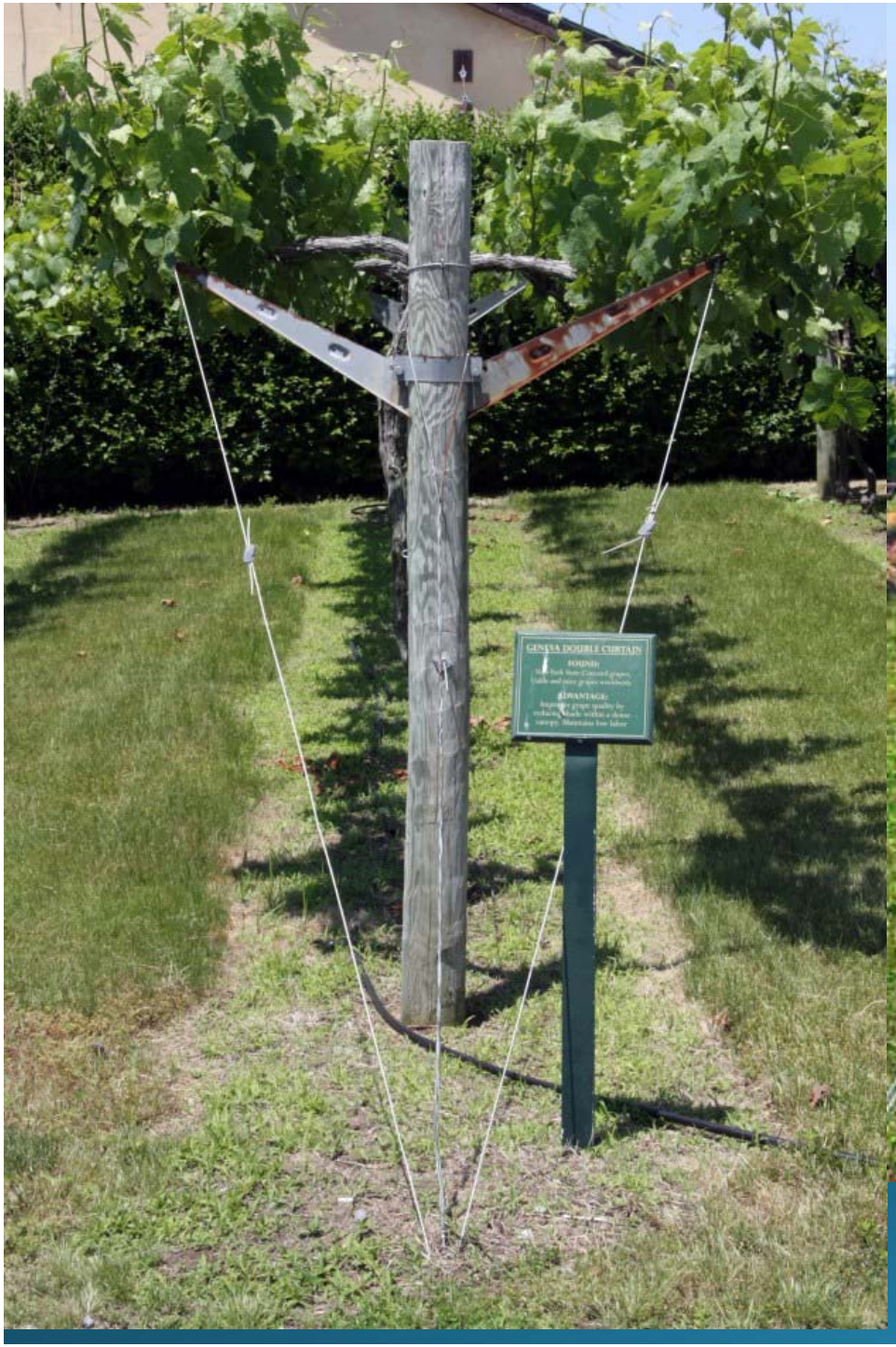
- Shoot Density is an Integral Component of a Balanced Canopy
- Ideal Shoot Density is Between 3-5 Shoots Per Linear Foot of Row or Canopy
- Assuming Cluster Weights of 1/3 lb. each, with 2 Clusters per Shoot, Vines Spaced at 10 x 6, with 5 Shoots Per Linear Foot are Cropped at a 6.5 TPA Level. 3 Shoots Per Linear Foot = 3.9 TPA

Shoot Density

- Shoot Density Can Be Addressed During Annual Dormant Pruning or Through Shoot Thinning Shortly After Budbreak
- Non-bearing Shoots May Be Removed, or in Some Cases Retained to Create New Spur Positions
- Remember, Summer Pruning is a Dwarfing Action!

Shoot Positioning

- Shoot Positioning Is an Integral Part of Vineyard Management Regardless of the Training System
- The Goal is to Uniformly Distribute Leaf Area and Fruit to Minimize Mutual Shading and to Improve Fruit Exposure and Ventilation
- Can Be Very Time Consuming… Growers Seek Ways to Get Job Done Efficiently


GENEVA DOUBLE CURTAIN

Shoot Positioning

- Shoot Positioning Should Be Conducted Several Times During the Year
- Should Begin When Shoots are Approximately 18" Long Before Tendrils Form Strong Attachments
- Shoots Remain Very Tender and Easy to Break Until Bloom When Lignification Begins

Trellis Configurations

Single Strand Training Wires

Trellis Configurations

"Super T" Posts

Trellis Configurations

Fixed Pairs of Catchwires

Moveable Catch Wires

Wires Can Be Moved From Lower T to Higher T Bringing Canopy Up With The Wires

High Cordon Systems

Summer Hedging

- Management Tool to Address Excessive Vigor
- Can Be Extremely Important, Especially in a Wet Year
- Vines are Topped Just Above Top of Post Removing Canes That Cause Shading
- Can Be Detrimental if New Forced Lateral Shoots Compete With Fruit for Photosynthates and Cause Excessive Lateral Shoot Growth

Selective Leaf Removal

- Removing Leaves in Fruiting Zone Increases Air Flow and Light & Spray Penetration
- Can Significantly Reduce Rot and Powdery Mildew
- Can Improve Fruit Quality
  - Increased Color
  - Increase in Flavor Compounds
  - Decrease in pH and K^{++}
  - Reduce Vegetative Aromas

Mechanical Options Are Available

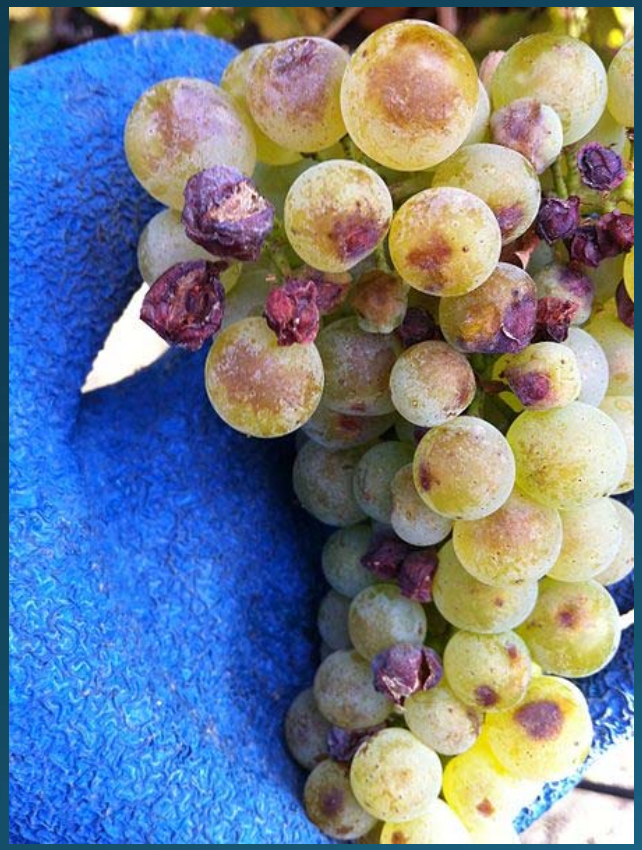

Under Texas Growing Conditions, Vine Leaf Removal
Should ,NOT Look Like This!

And Don't Even Think About It

Practical Tips For Leaf Removal in Texas

- Consider Removing Leaves only on the Shaded Side of the Canopy (East Side of N/S Rows or North Side of E/W Rows
- Start Early! Two to Three Weeks After Fruit Set
- In Our Climate, We are Only Looking For Partial Cluster Exposure

Late or Excessive Leaf Removal Will Result in Sun Scalded Fruit



The Characteristics of An Ideal Canopy- Shoot Density

3-5 Shoots Per Linear Foot of Canopy or Row

Higher Values Promote Shading and Over-cropping And Lower Values Lead to Excessively Vigorous Shoot Growth and Low Yields

Adapted From Smart & Robinson, 1991 & Wolf Et. Al, 2008

The Characteristics of An Ideal Canopy- Shoot Length

15-20 Nodes

Shoots With Less Than 15 Nodes are Symptomatic of Inadequate Vigor. Untrimmed Shoots Greater Than 20 Nodes Indicate Excessive Vigor.

Adapted From Smart & Robinson, 1991 & Wolf Et. Al, 2008

The Characteristics of An Ideal Canopy- Lateral Shoot Development

Ideally None

Excessive Lateral Growth Leads to Shade and Competes With Fruit. The Presence of a Few Laterals May Assist in Maturation of Fruit & Wood

Adapted From Smart & Robinson, 1991 & Wolf Et. Al, 2008

What Are The Characteristics of An Ideal Canopy- Growing Shoot Tip

Ideally Stopped

Best Scenario is For Shoot Tip To No Longer Growing By Véraison

Adapted From Smart & Robinson, 1991 & Wolf Et. Al, 2008

What Are The Characteristics of An Ideal Canopy- Individual Cane Weights

Individual Canes Should Weigh Between 0.06-0.10 lbs per Dormant Cane.

Weights Below 0.06 lbs Suggest Inadequate Vigor . Canes Above 0.1 lbs are Indicative of "Bull Wood" That is Low in Fruitfulness and Subject to Winter Injury

Adapted From Smart & Robinson, 1991 & Wolf Et. al, 2008

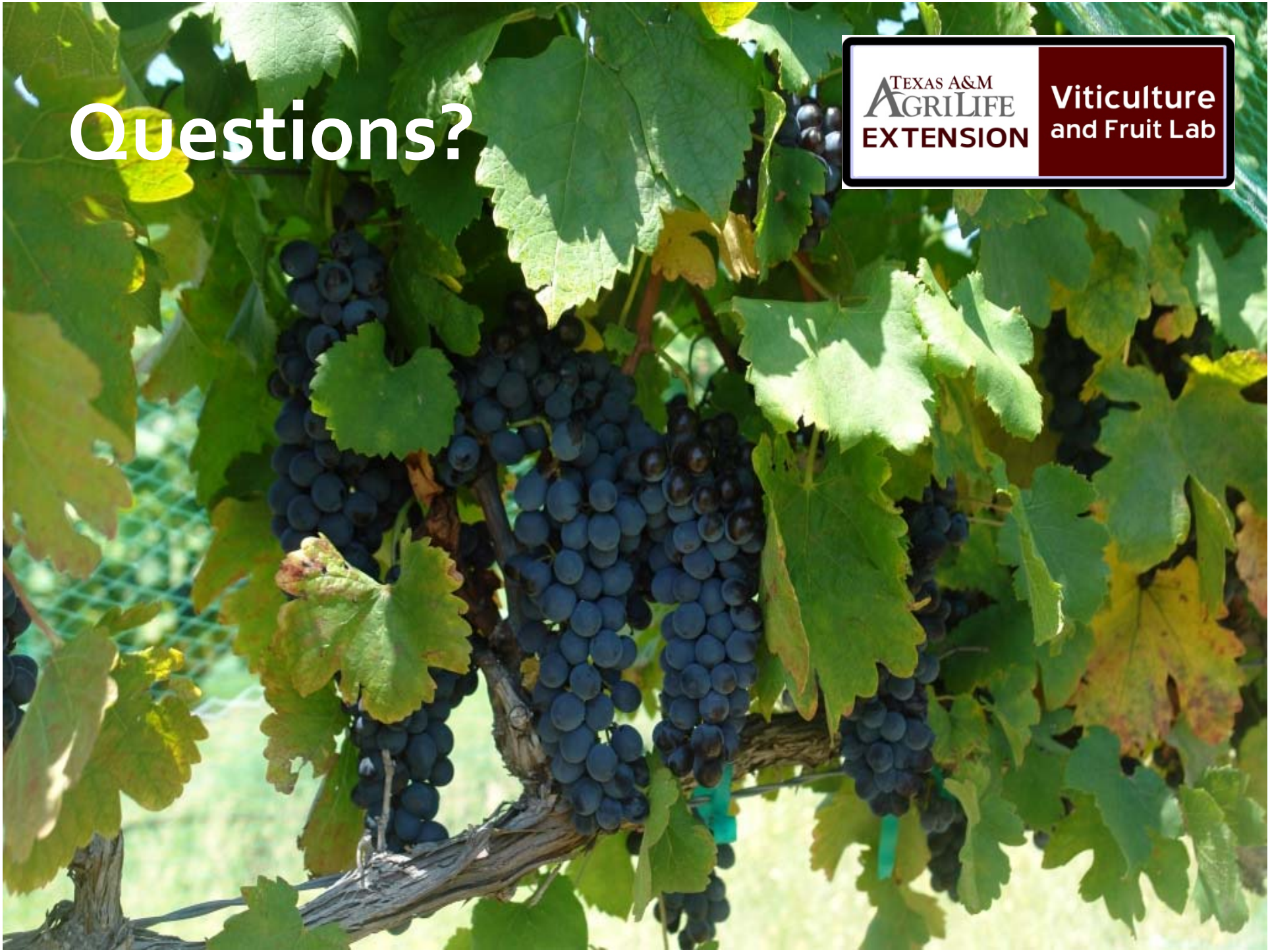
What Are The Characteristics of An Ideal Canopy- Ratio of Crop Weight to Pruning Weight

5 – 10 : 1

Values Less Than 5 are Indicative Of Under-cropping and Values Over 10 Are Considered Over-cropping. These Values, However Are Variety Specific

Adapted From Smart & Robinson, 1991 & Wolf Et. Al, 2008

Questions?



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