Pruning and Training Principles for Balanced Vines

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Definitions

Pruning can be defined as “the annual removal of plant parts to obtain production objectives”. These objectives include:

- Controlling the size & form of the grapevine.
- Optimize the production potential of the grapevine.
- Maintain a balance between vegetative growth and fruiting.

Training can be defined as “the development of plant parts spatially”. This is done to develop a structure that:

- Optimizes the exposure to sunlight that promotes productivity.
- Evenly distributes fruit-bearing units in the vine row space.
- Adapts to the characteristics of the grape cultivar.
- Promotes efficient & sustainable vineyard practices.
- Is economical to establish and maintain.
Definitions

**Dormant Pruning** can be defined as “the annual removal of dormant wood.”

**Summer Pruning** can be defined as “the removal of green vine parts.”

- Shoot thinning
- Leaf removal
- Hedging
- Flower or cluster thinning
Reasons for Pruning

1. Control vine shape and size to facilitate the cultural operations

2. Select fruiting units to optimize bud fruitfulness and space shoots and fruit over a larger area

3. Regulate crop size
Bulletin 119: Vine Pruning, 1897
F. T. Bioletti

“Physiological Principles of Vine Pruning (7)”
Vigor vs. Capacity

- **Vine vigor** is a measurement of the rate of vine growth.
- **Vine capacity** is the total annual vegetative and fruit biomass produced.

Capacity refers to the vine’s ability for total production rather than rate of growth.
Principles of Pruning (Winkler)

1. Grapevines have a fixed capacity
2. Pruning tends to depress growth
3. Production of crop depresses vine capacity
4. Fruitfulness varies with shoot vigor
5. Shoot vigor varies inversely with shoot number and crop load
6. Vine capacity is proportional to total growth
7. Vines can self-regulate
8. Direction of growth influences type of growth
What is a “balanced vine”? 

Leaf area or vegetative growth  

Fruit yield or reproductive growth
Vine Spacing

- Too Narrow: 28 in
- Optimum: 48 in
- Too Wide: 68 in

From: Intrieri and Filipetti American Journal of Enology and Viticulture, 50th Anniversary
Berry size, sugar, color

Region where cluster removal has little impact on composition

Region where cluster removal improves composition

Leaf area (m²) / kg fruit weight

0.6 - 1.5 m² leaf area per kg fruit weight
~5 to 10 lbs fruit per lb pruning weight
Crop load indices

- Leaf area (cm²) : fruit wt (g)
- Fruit yield (lbs) : pruning wt (lbs)
Fig. 12. Regression of crop weight/pruning weight ratios against leaf area/crop weight ratios of Cabernet Sauvignon vines for the 1994 season. Treatments regressed included six trellis training systems, three in-row spacings (1, 2, and 3 m), and two rootstocks (039-16 and 110R).
## Canopy Characteristics

<table>
<thead>
<tr>
<th>Indices</th>
<th>Measure</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Fruit yield</strong></td>
<td>Production efficiency</td>
</tr>
<tr>
<td>pruning weight</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
</tr>
<tr>
<td>Exposed leaf area</td>
<td>Canopy efficiency</td>
</tr>
<tr>
<td>Total leaf area</td>
<td>-fruit ripening capacity</td>
</tr>
<tr>
<td></td>
<td></td>
</tr>
<tr>
<td>Exposed clusters</td>
<td>Fruit exposure</td>
</tr>
<tr>
<td>Total clusters</td>
<td>-composition and flavor</td>
</tr>
</tbody>
</table>
Measuring “balance”

Yield / Pruning Weight ratios

- Lbs of crop / lbs of prunings per vine
  - <3 Undercropped
  - 4-8 Normal
  - >10 Overcropped

Reds generally lower than whites
## Characteristics of the Ideal Wine Grape Canopy

<table>
<thead>
<tr>
<th>Canopy Character</th>
<th>Optimal Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Shoot density</td>
<td>~ 5 shoots per foot</td>
</tr>
<tr>
<td>Shoot length,</td>
<td>15 to 20 nodes</td>
</tr>
<tr>
<td>Lateral shoot development</td>
<td>None to very minimal</td>
</tr>
<tr>
<td>Growing shoot tip presence</td>
<td>Ideally none</td>
</tr>
</tbody>
</table>
| Ratio of leaf area to fruit weight           | 3 to 8 ft\(^2\)/lb  
                             | (0.6 to 1.5 m\(^2\)/kg)                           |
| Leaf layer number                            | 1-2                                               |
| Percent exterior leaves                      | 80-100%                                            |
| Percent exposed clusters                     | 50 to 80%                                          |
| Cane weight                                  | 0.7 to 1.4 oz  
                             | (20 to 40 g)                                       |
| Internode length                             | 2.4 to 3.1 in  
                             | 6 to 8 cm                                          |
| Pruning weight                               | 0.2 to 0.4 lb/ft  
                             | (0.3 to 0.6 kg/m)                                  |
| Ratio of crop weight to pruning weight       | 5-10                                              |

Adapted from Smart and Robinson 1991
Training/Pruning Systems
Trellis Options
Cordon Training

- Unilateral
- Bilateral
- Multiple Cordon Systems
Split Canopy Configurations

- Standard Quadrilateral Bilateral "U"
- Bilateral "S" Alternating Bilateral
- 4 x 4
- 2 x 8 2 x 8
- 2 x 8
- 2 x 8

Bilateral "U"
Alternating Bilateral
Head Training

Spur Pruning

Cane Pruning
Head Trained - Spur Pruned
Head Training
Head Trained - Cane Pruned
Pruning Systems

Cordon
- Spur
- Spur/Cane combination
- Mechanical

Head
- Spur
- Cane
**Fruiting Units**

1. Spurs

2. Canes
Cordon Pruning

Advantages
- Pruning can be mechanized
- Lower labor hours
- Even budbreak
- Requires less skill to prune

Disadvantages
- Buds can be less fruitful
- Low bud fruitfulness can result in high vigor cycle
Spur Selection
Cane Pruning

Advantages
- Retains the most fruitful buds
- Yield advantages

Disadvantages
- More labor hours to prune
- Pruning more difficult to mechanize
- Poor budbreak on canes
- Requires more experienced pruners
Cane Pruning

cut 1

RS
RNS
NC1
NC2
NC3
OS
OC

cut 2

cut 3

cut 4
Pruning level depends on:

1. Cultivar
2. Climate
3. Site conditions/vigor
4. Trellis - training system
Pruning Level Criteria

1. Balanced pruning (30 + 10)
2. Yield: Pruning ratio (5-10)
3. Golden rule of viticulture (Smart)
   a. 12-16 buds/lb. pruning weight
   b. 5 buds/ft. of canopy