Pruning and Training Young Walnuts

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Pruned versus unpruned trials during canopy development phase

- Howard pruned versus unpruned trial
  - Nickels Soil Lab 2003-2009
- Chandler pruned versus unpruned trial
  - Nickels Soil Lab 2008-2013 (ongoing)

Other pruned versus unpruned trials initiated around state

Height of heading at planting trial
Howard Pruning treatments imposed in March 2004-after scaffold selection following second growing season
12’ x 25’ spacing (145 trees/acre)

Unpruned after scaffold selection

Pruned (1/3 of previous year growth each year until tree fills allotted space)
March 2005

Cumulative yield (tons/acre)

Unpruned

Pruned
March 2006

Cumulative yield (tons/acre)

<table>
<thead>
<tr>
<th>Year</th>
<th>Unpruned</th>
<th>Pruned</th>
</tr>
</thead>
<tbody>
<tr>
<td>2006</td>
<td>a</td>
<td>a</td>
</tr>
</tbody>
</table>

The chart shows the cumulative yield for unpruned and pruned plots in March 2006, with both plots having the same yield.
March 2007

Cumulative yield (tons/acre)

2007

Unpruned

Pruned
February 2009

Cumulative yield (tons/acre)

2009

Unpruned

Pruned
Howard pruned versus unpruned trial

After 8 years of treatment imposition, no benefits to pruning
Chandler pruned versus unpruned trial

Chandler orchard planted at 15 x 22 ft.
Planted 2008
Nursery budded on Paradox rootstock
March 2009 pruning treatments imposed
Treatments
  – Heavily pruned
  – Minimally pruned
  – No heading/no pruning
Chandler pruned versus unpruned trial

Chandler orchard planted at 15 x 22 ft.
Planted 2008
**Nursery budded on Paradox rootstock**
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Planted 2008
Nursery budded on Paradox rootstock
March 2009 pruning treatments imposed

Treatments
- Heavily pruned
- Minimally pruned
- No heading/no pruning
After first growing season
Before pruning

- Heavy pruning
- Minimal pruning
- Unheaded/unpruned

12/16/09

After pruning

- Heavy pruning
- Minimal pruning
- Unheaded/unpruned

3/29/10

After second growing season
Before pruning

Heavy pruning

Minimal pruning

Unheaded/unpruned

12/16/09

12/16/09

12/16/09

After second growing season

Heavy pruning

Unheaded/unpruned

3/29/10

Cumulative yield (tons/acre)

<table>
<thead>
<tr>
<th>Treatment</th>
<th>Cumulative yield</th>
</tr>
</thead>
<tbody>
<tr>
<td>Hard pruned</td>
<td>0.005</td>
</tr>
<tr>
<td>minimal</td>
<td>0.005</td>
</tr>
<tr>
<td>No heading</td>
<td>0.030</td>
</tr>
</tbody>
</table>

2nd leaf

Hard pruned  minimal  No heading

Cumulative yield

0.000  0.015  0.030

a

b  b
Before pruning

Heavy pruning

Minimal pruning

Unheaded/unpruned

1/24/11

After third growing season

After pruning

Heavy pruning

Minimal pruning

Unheaded/unpruned

4/5/11
Before pruning

Heavy pruning

Minimal pruning

Unheaded/unpruned

After third growing season

Cumulative yield (tons/acre)

3rd leaf

Hard pruned

minimal

No heading

Treatment

Cumulative yield (tons/acre)

a

b

c

0

2

4

6

8

10
Before pruning

Heavy pruning

Minimal pruning

Unheaded/unpruned

1/15/12

1/15/12

1/15/12

12/30/12

12/30/12

12/30/12

After fourth growing season
Before pruning

Heavy pruning

Minimal pruning

Unheaded/unpruned

4th leaf

Treatment

Hard pruned minimal No heading

Cumulative yield (tons/acre)

0

2

4

6

8

10

a

a

a

After fourth growing season
Cumulative yield by treatment and year for Chandler

Nickels Chandler pruning trial

Cumulative yield to 2013 (6th leaf)

- Heavily pruned
- Minimally pruned
- Unheaded and unpruned

Year
- 2009
- 2010
- 2011
- 2012
- 2013
Midday canopy light interception by treatment and year for Chandler

The graph shows the canopy PAR interception (%) over years for different treatments: Heavily pruned (T1), Minimal pruned (T3), Unheaded and unpruned (T4). The treatment effects are evident by the varying slopes and positions of the lines across different ages and years.
Minimal pruning

Unheaded/unpruned

- Yield significantly higher
- Light interception significantly lower
Higher midday canopy light interception combined with lower yield indicates lower water use efficiency for pruned treatments in years 2-6.
Water needed to support canopy based on proportion of 42 inches needed at 60% canopy cover

<table>
<thead>
<tr>
<th>Age</th>
<th>2</th>
<th>3</th>
<th>4</th>
<th>5</th>
<th>6</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
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</tr>
</tbody>
</table>

10 inches more water needed in minimal compared to unpruned in 3rd leaf

3rd leaf yield

- Unpruned: 0.73 tons/ac
- Minimal: 0.33 tons/ac
- Heavy: 0.14 tons/ac
A tree that looks like this has stalled out from overwatering, not from lack of pruning.

Based on canopy size, 10 inches more water needed for minimally pruned in 3rd leaf.
### Water use efficiency for pruned versus unpruned treatments

**Years 2-6 summary**

<table>
<thead>
<tr>
<th>Treatment</th>
<th>Total water needed based on canopy size (years 2-6)</th>
<th>Cumulative yield (tons/acre)</th>
<th>Water use efficiency expressed as pounds of walnuts produced per inch of water applied</th>
<th>Water use efficiency (% of unpruned)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Unpruned</td>
<td>134</td>
<td>6.51</td>
<td>97</td>
<td>100</td>
</tr>
<tr>
<td>Minimally pruned</td>
<td>156</td>
<td>5.93</td>
<td>76</td>
<td>78</td>
</tr>
<tr>
<td>Heavily pruned</td>
<td>142</td>
<td>5.20</td>
<td>73</td>
<td>75</td>
</tr>
</tbody>
</table>
Chandler pruning trial summary

• Heavy pruning resulted in smaller trees and less yield in years 1-4
• After 6 years, cumulative yields are similar for unpruned and minimally pruned but significantly less for heavily pruned
• Water use efficiency higher in unpruned
• Pruning led towards tendency towards increased crown gall
• There were no benefits to either minimal or heavy pruning in this trial

The Howard and Chandler pruned versus unpruned trials do not support the common wisdom that you need to prune walnuts to get them to grow and be productive
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If you don’t head a shoot, it will grow in alternate years.

Heavily pruned

Unheaded/unpruned

These shoots are one year behind in development.
In 2012 through 2013

• Pruned versus unpruned trials initiated in grower orchards in Butte, Contra Costa, Lake, Merced and Tulare Counties
3rd Leaf own-rooted Chandler in Contra Costa County

Feb. 18, 2014

Headed  Unpruned
3rd Leaf Chandler in Lake County - moderate to severe cold damage on most trees in spring of 2013

July 19, 2013

Headed
PAR interception  6.4%

Unheaded, unpruned
7.3%
4th Leaf Forde in Butte County - Chico State Univ.

PAR interception

Pruned: 45.3%

Unheaded, unpruned: 46.2%

Oct. 12, 2013
3rd Leaf Howard near Durham in Butte County

<table>
<thead>
<tr>
<th>Trunk circumference (cm)</th>
<th>Headed</th>
<th>Unheaded/unpruned</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>33.2</td>
<td>33.7</td>
</tr>
</tbody>
</table>
### 3rd Leaf Chandler in Merced County

<table>
<thead>
<tr>
<th></th>
<th>Headed</th>
<th>Unheaded, unpruned</th>
</tr>
</thead>
<tbody>
<tr>
<td>PAR interc. (%)</td>
<td>24.8 a</td>
<td>23.9 a</td>
</tr>
<tr>
<td>Yield (lb/ac)</td>
<td>671 b</td>
<td>1348 a</td>
</tr>
</tbody>
</table>
3rd Leaf Chandler in Tulare County - grower stopped pruning trial after one year since yields were higher on unpruned

<table>
<thead>
<tr>
<th></th>
<th>Headed</th>
<th>Unheaded, unpruned</th>
</tr>
</thead>
<tbody>
<tr>
<td>Yield (lbs/acre)</td>
<td>155</td>
<td>174</td>
</tr>
</tbody>
</table>
How to train and prune using different methods

- Heavily pruned
- Minimally pruned
- Untrained/unpruned
Heavily pruned- don’t do this
Minimal pruning - winter following 1st leaf

Grow leader to 10 feet plus the first season
Remove and in-season branching points
Necked buds should be removed
Necked bud left in main structure
Minimal pruning - winter following 2\textsuperscript{nd} leaf

Before pruning

Only head selected leader as well as 4-5 other branches destined to be main scaffolds (1/4 to 1/3 of previous years growth removed)

After pruning

Remove forks

Remove branches below 4’
Minimal pruning - winter following 3\textsuperscript{rd} leaf

Before pruning

After pruning

Same as previous year
Untrained/unpruned- winter following 1st leaf

Singulate to single leader
Untrained/unpruned- winter following 2\textsuperscript{nd} leaf

May want to remove in season branching points although we did not after first dormant period.

Remove lower branches- do not head them but rather remove entirely to main trunk.
Untrained/unpruned- winter following 3\textsuperscript{nd} leaf on

Watch them grow in summer and go skiing in winter
Nickels Chandler pruning trial
01/15/12

Unpruned
~20 branches off of main trunk
1 broken branch = 5% of canopy

Minimally pruned
4-6 branches off main trunk
1 broken branch=16-25% of canopy
We rarely see broken branches in unpruned trees but if we do it is usually in the 3rd or 4th leaf when they are still quite small (and a small part of canopy)

- No broken branches in unpruned treatment in Nickels Chandler trial and most in minimally pruned treatment

In pruned trees breakage tends to occur 3 or so years after pruning stops (usually 5-7 leaf) and a large part of canopy is lost (maybe 15-20%)

Breakage 3 years after pruning stopped in Chandler orchard in Lake County
Shading related dieback will occur earlier.

Heavily pruned

Unheaded/unpruned

More open structure

Longer light path

Shorter light path

Flatter branch angles

December 2012
Quality problems in the center of the tree tend to be less severe with a central leader tree structure—shorter light path through the tree.

Yellow pellicles

Bronze pellicles

Black pellicles

Shriveling
In our pruned versus unpruned trials in walnut, after a total of 13 years of data collection (7 years on Howards and 6 years on Chandlers), we have yet to find an advantage to any pruning cut except those made to provide orchard access or remove in season branching points in 1\textsuperscript{st} or maybe 2\textsuperscript{nd} leaf.

Pruning related problems (besides money spent to prune and dispose of prunings)

- Slightly lower quality/size for pruned in some cases
- More scaffold breakage in years after pruning stops
- More rapid shading of lower canopy - this is related to quality problems
- Lower water use efficiency
- Potentially more crown gall with pruning
Nickels Chandler Pruning Trial Field Day

Heavy pruning  Minimal pruning  Unheaded/unpruned

1/30/14  1/30/14  1/30/14

Field day will be held at this site on March 3rd, 2014 at 9:30 am
(March 5th at 9:30am if it rains on March 3rd)
Location- Nickels Soil Lab, Green Bay Avenue, Arbuckle, CA

Another field meeting will be held at 2:30 the same afternoon near Wheatland to look at a grower trial with pruned and unpruned walnuts- UCCE Yuba/Sutter Counties for information or contact Janine Hasey (jkhasey@ucanr.edu)
Questions?