New Orchard Development: Site Evaluation through Planting

David Doll
Farm Advisor
UCCE Merced County
New Orchard Development

1. Site Evaluation
2. Site Sampling
3. Orchard Removal
4. Soil Amended/Modification
5. Soil Fumigation
6. Orchard Planting
Site Evaluation: Soil Differences

Learn from the old orchard!

Aerial image through Google Earth, walking the field

Determine areas of variability and address
• Soil Modification – ripping, backhoeing, slip-plowing

• Irrigation system – High volume/low volume

• Rootstocks – Determine options for salinity, boron, alkalinity, high water table, etc.
Site Evaluation: Soil Differences

Soil Map: Soils-2-Go, NRCS, Google Earth, etc.
Site Evaluation: Electrical Conductivity Mapping

Measures the EC of the soil, which can relate to texture, salinity differences.

Can group areas by texture or type to increase water, nutrient efficiency, yield
Site Evaluation: Backhoe Pits
Backhoeing Soil Pits – Why?

1. Determines soil layering
2. Uncovers the soil’s secrets
3. Provides opportunity to sample various depths of soil
New Orchard Development

1. Site Evaluation
2. Site Sampling
3. Orchard Removal
Orchard Removal

**Tub Grinder**

**Pull and Burn**

“Iron Wolf”
<table>
<thead>
<tr>
<th></th>
<th>Stack and Burn</th>
<th>Grind and Haul (Tub Grinders)</th>
<th>Grind, Shred, and Incorporate (Iron Wolf)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Removal Time</td>
<td>Fast</td>
<td>Medium</td>
<td>Slow</td>
</tr>
<tr>
<td>Required Permits</td>
<td>Yes – size and county dependent</td>
<td>No</td>
<td>No</td>
</tr>
<tr>
<td>Root Ripping/Removal</td>
<td>Yes 3-5 passes</td>
<td>Yes 3-5 passes</td>
<td>No</td>
</tr>
<tr>
<td>Soil benefits</td>
<td>Some</td>
<td>Minimal</td>
<td>Increased OM, microbial activity, more??</td>
</tr>
<tr>
<td>Growth Issues</td>
<td>Minimal</td>
<td>Some (piles)</td>
<td>Minimal</td>
</tr>
</tbody>
</table>
New Orchard Development

1. Site Evaluation
2. Site Sampling
3. Orchard Removal
4. Soil Amending/Modification
Soil Modification

Slip-Plow

Backhoe

Ripper
# Soil Modification - Generalizations

<table>
<thead>
<tr>
<th></th>
<th>Ripping</th>
<th>Slip Plow</th>
<th>Backhoe</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Strength</strong></td>
<td>Shattering Hardpan</td>
<td>Mixing Layers</td>
<td>Mixing Layers</td>
</tr>
<tr>
<td><strong>Cons</strong></td>
<td>Doesn’t Mix Layers – tend to reform</td>
<td>Expensive to break hardpans, settling, pulls up “bad stuff”</td>
<td>Expensive, settling</td>
</tr>
<tr>
<td><strong>Areas of Use</strong></td>
<td>Hardpan within the first 4 feet</td>
<td>Extensive fine and coarse layering, heavier soils</td>
<td>Area of layering, compaction, lighter soils</td>
</tr>
</tbody>
</table>
Soil Modification – Slip Plow?

1 foot of clay-loam, followed by 1 foot of sandy-loam, 1 foot of clay-loam

2 feet of “good” followed by multiple layers of clay, sand, etc.
Soil Modification – Slip Plow?

2 feet of sandy loam, followed by several feet of sandy clay-loam

3 feet of “good” followed by 3 feet of gravel.
## Soil Modification – Slip Plow?

<table>
<thead>
<tr>
<th>Year</th>
<th>Tree Age (years)</th>
<th>Slip Plowed (lb/ac)</th>
<th>Non-Slip Plowed (lb/ac)</th>
</tr>
</thead>
<tbody>
<tr>
<td>2000</td>
<td>4</td>
<td>894</td>
<td>830</td>
</tr>
<tr>
<td>2001</td>
<td>5</td>
<td>1070</td>
<td>1243</td>
</tr>
<tr>
<td>2002</td>
<td>6</td>
<td>2725</td>
<td>2761</td>
</tr>
<tr>
<td>2003</td>
<td>7</td>
<td>2165</td>
<td>2323</td>
</tr>
<tr>
<td>2004</td>
<td>8</td>
<td>1869</td>
<td>1865</td>
</tr>
<tr>
<td>2005</td>
<td>9</td>
<td>1548</td>
<td>1841</td>
</tr>
<tr>
<td>2006</td>
<td>10</td>
<td>2910</td>
<td>2862</td>
</tr>
<tr>
<td>2007</td>
<td>11</td>
<td>2770</td>
<td>2571</td>
</tr>
<tr>
<td>2008</td>
<td>12</td>
<td>3771</td>
<td>3686</td>
</tr>
<tr>
<td>Cumulative</td>
<td></td>
<td>19722</td>
<td>19982</td>
</tr>
</tbody>
</table>

Arbuckle Sandy Loam, with clay underlayer, Micro-sprinkler irrigated

Slip-plowing brought rocky layer to surface

Slip Plowing probably still benefits highly layered soils

New Orchard Development

1. Site Evaluation
2. Site Sampling
3. Orchard Removal
4. Soil Amended/Modification
5. Soil Fumigation
Healthy (L) and replant disease-affected (R) almond trees, Madera County 2007
Abiotic factors (physical, chemical conditions related to previous production)

Aggressive pathogens, pests (Phytophthora, Armillaria, Verticillium, Ten-Lined June Beetle) – localized, not managed completely by fumigation

Plant-parasitic nematodes (ring, lesion, root knot), approx. 35% of almond and fresh stone fruit acreage, 60% of cling peach acreage infested (McKenry)

Replant disease (RD) Microbe-induced growth suppression; incidence nearly universal in Prunus after Prunus, but severity varies greatly

Symptoms of replant disease on almond
## Orchard Replanting – Replant Problems

<table>
<thead>
<tr>
<th></th>
<th>Not Advised</th>
<th>Broadcast Telone II</th>
<th>Rowstrip C35, Chloropicrin</th>
</tr>
</thead>
<tbody>
<tr>
<td>No Orchard History - Fallow Field, no nematodes</td>
<td>X</td>
<td></td>
<td></td>
</tr>
<tr>
<td>No Orchard History – w/Nematodes</td>
<td></td>
<td>X – Population dependent</td>
<td>X – Population dependent</td>
</tr>
<tr>
<td>Orchard History, No Nematodes, Sandy Loams or coarser</td>
<td></td>
<td></td>
<td>X – C35</td>
</tr>
<tr>
<td>Orchard History, No Nematodes, Silt/Clay Loams or finer</td>
<td>Possible</td>
<td>Some benefit</td>
<td></td>
</tr>
<tr>
<td>Orchard History w/Nematodes</td>
<td>X - Population dependent</td>
<td>X - Population dependent</td>
<td></td>
</tr>
<tr>
<td>Orchard History with Aggressive Pathogens</td>
<td></td>
<td>Some benefit</td>
<td></td>
</tr>
</tbody>
</table>
Orchard Replanting – Replant Problems

<table>
<thead>
<tr>
<th>Fumigant(^a)</th>
<th>Treated area(^b)</th>
<th>Mulch</th>
<th>lb/treated acre(^c)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Control</td>
<td>None</td>
<td>None</td>
<td>0</td>
</tr>
<tr>
<td>Control</td>
<td>None</td>
<td>VIF</td>
<td>0</td>
</tr>
<tr>
<td>MB</td>
<td>Br. (100%)</td>
<td>None</td>
<td>400</td>
</tr>
<tr>
<td>MB</td>
<td>R. strip (38%)</td>
<td>None</td>
<td>400</td>
</tr>
<tr>
<td>MB</td>
<td>R. strip (38%)</td>
<td>VIF</td>
<td>400</td>
</tr>
<tr>
<td>Telone II</td>
<td>Br. (100%)</td>
<td>None</td>
<td>340</td>
</tr>
<tr>
<td>Telone II</td>
<td>R. strip (38%)</td>
<td>None</td>
<td>340</td>
</tr>
<tr>
<td>Telone II</td>
<td>R. strip (38%)</td>
<td>VIF</td>
<td>340</td>
</tr>
<tr>
<td>Telone C35</td>
<td>Br. (100%)</td>
<td>None</td>
<td>535</td>
</tr>
<tr>
<td>Telone C35</td>
<td>R. strip (38%)</td>
<td>None</td>
<td>535</td>
</tr>
<tr>
<td>Midas</td>
<td>Br. (100%)</td>
<td>None</td>
<td>400</td>
</tr>
<tr>
<td>Midas</td>
<td>R. strip (38%)</td>
<td>None</td>
<td>400</td>
</tr>
<tr>
<td>CP</td>
<td>Br. (100%)</td>
<td>None</td>
<td>400</td>
</tr>
<tr>
<td>CP</td>
<td>R. strip (38%)</td>
<td>None</td>
<td>400</td>
</tr>
<tr>
<td>CP</td>
<td>R. strip (38%)</td>
<td>VIF</td>
<td>400</td>
</tr>
</tbody>
</table>

Significance at p<0.05

Kernal pounds per acre
New Orchard Development

1. Site Evaluation
2. Site Sampling
3. Orchard Removal
4. Soil Amended/Modification
5. Soil Fumigation
6. Tree Planting
**Tree Planting: Berms?**

**Flat:**
- Easiest to use with equipment
- Use only in soils with quick drainage (loamy sands-sands)

**Standard Berm:**
- 8”+ in height, 5’ wide
- Drains water away from crown, keeps roots out of water
- Issues with harvest, weeds, equipment
- Generally recommended

**Raised Bed:**
- 20”+ in height, 11’ wide
- Possible use in shallow soils
- Increase in yield v/s berm
- Issues with equipment
- Experimental, but feasible
Tree Planting – Method

Machine Planting

1. Plants Quickly, Accurately
2. Can create berm as it plants
3. Fewer issues with planting (improper hole size)
4. Limitations on heavy soil and rains?

Hand Planting

1. More control on the planting conditions
2. Can adjust for larger rooting trees
3. No limited on soil types, conditions
4. Possible problems with “scoop, ball, and shove” method on root development
Tree Planting - Method

- Dig a big hole
- Plant high
  - Highest root should be covered with a few inches of soil
  - Graft union must be above soil line
  - Allow 3-4 inches for settling
- Tank in the tree with 3-5 gallons of water
  - Re-tank if needed (i.e. hot weather)
- Trim branches, high heading cut (36”+)
Fertilizing First Year Trees

Change in Trunk Diameter (mm)

Pounds of Nitrogen/Acre

Conventional

120 Day Controlled Release

180 Day Controlled Release
New Orchard Development

Conclusions
Conclusions

“Ounce of prevention is worth a pound of cure”

Only time in the orchards life that soil can be thoroughly evaluated, modified, fumigated.

Pulling berms after planting is a mistake as it often buries the graft union

Planting the tree properly prevents windthrow, crown gall, and increases vigor

Still working on young orchard nitrogen rates!