Choosing the Best Almond Rootstock for Your Orchard

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Stanislaus County
What is the best rootstock?

• Rootstock choice should be site specific
What Do We Want in an Almond Rootstock?

- Compatibility
- Strong vigor / high yield efficiency
- Good anchorage
- Low / no suckering
- Tolerance to “heart rot” / wood decay fungi
Nemaguard

- Advantages
  - “Immune” to rootknot nematode
  - Vigorous rootstock
  - Compatible with all almond varieties
  - Performs well in sandy loam & loam soils
  - “Decent” anchorage
Nemaguard

- Disadvantages
  - **Susceptible to:**
    - Ring & root lesion nematodes
    - Bacterial canker
    - High soil pH / high lime
    - Salt (sodium, chloride, boron)
    - Phytophthora / “wet feet”
    - Oak root fungus
    - Crown gall
    - “Heart” rot / wood decay fungi
Lovell

- Very similar to nemaguard in many ways
  - About 90% the size of nemaguard in sandy loam soils
  - A little better than nemaguard in heavy soil
  - Highly susceptible to rootknot nematode
  - More tolerant to ring nematode than most other commercial stocks
Peach / Almond Hybrids

- Includes Hansen, Nickels, Bright’s Hybrid Cornerstone, Titan Hybrid, Paramount

- Advantages
  - Very high vigor
  - Tolerant to high lime / high pH soils
  - Tolerant to high boron, sodium & chloride
  - Very good anchorage
  - Resistant to rootknot nematode
Peach / Almond Hybrids

- Disadvantages
  - Very high vigor
  - Highly susceptible to ring nematode and bacterial canker
  - Highly susceptible to most root diseases
    - Phytophthora
    - oak root fungus
    - crown gall
Nemaguard
Nickels
5th leaf
### Yield (kernel pounds per acre) of Nonpareil & Carmel Almond Trees in 2010 (8th Leaf) & Cumulatively (4th – 8th Leaf).

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<thead>
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<td>Empyrean #1</td>
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<td>Julior</td>
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## Salinity Tolerance of P/A Hybrid Rootstocks

**Atwater rootstock trial, 2006**

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<thead>
<tr>
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<th>Na (%)</th>
<th>Cl (%)</th>
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<tr>
<td>Nemaguard</td>
<td>0.64</td>
<td>0.22</td>
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<tr>
<td>Lovell</td>
<td>0.72</td>
<td>0.26</td>
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<td>Hansen</td>
<td>0.17</td>
<td>0.09</td>
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<td>Brights</td>
<td>0.20</td>
<td>0.07</td>
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<tr>
<td><strong>Critical level</strong></td>
<td>&gt;0.25%</td>
<td>&gt;0.3%</td>
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Effect of Rootstock on Hullsplit of Nonpareil Almond.
July 30, 2008

- Nickels
- Barrier 1
- Cornerstone
- Hansen
- Cadaman
- Paramount
- Lovell
- Guardian
- Atlas
- Kuban
- Viking
- Adesoto
- Nemaguard
- Penta

Percent hullsplit:

- Nickels: E
- Barrier 1: DE
- Cornerstone: DE
- Hansen: CDE
- Cadaman: BCD
- Paramount: BCD
- Lovell: BC
- Guardian: B
- Atlas: B
- Kuban: B
- Viking: AB
- Adesoto: AB
- Nemaguard: AB
- Penta: A

Percent hullsplit range: 0 to 100
Nickels dead from Phytophthora – spring 2007
Crown Gall on Hansen Rootstock
Bacterial Canker

- Highly correlated to ring nematode
- Sand / loamy sand
- Replanted orchards
**Complex Hybrids**

- **Viking** *(peach x almond x plum x apricot)*
  - Similar in size to nemaguard
  - Resistant to rootknot nematode
  - Tolerant to ring nematode
  - Bacterial canker tolerance is similar to Lovell but with higher yields
  - More tolerant to high pH, sodium & chloride than peach rootstocks
  - Good anchorage
Soil Numbers of Pathogenic Nematodes as Influenced by Almond Rootstock
Escalon, CA. January, 2005
A Comparison of Almond Rootstocks for Incidence of Bacterial Canker

Escalon, CA  2005 (8th leaf)

- Peach / almond hybrid rootstocks are very susceptible to bacterial canker
- Viking, Lovell & Guardian are tolerant
Complex Hybrids

- Atlas – (peach x almond x plum x apricot)
  - More tolerant to high pH, sodium & chloride than peach rootstocks
  - Has shown high yield efficiency in several UC trials
  - Resistant to root knot nematode
  - Susceptible to ring nematode and bacterial canker
  - Unknown susceptibility to other root diseases
<table>
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<th>Rootstock</th>
<th>Chloride (%)</th>
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# Rootstock Influences on Tree Nutrition

**Escalon Rootstock Trial Leaf Analyses, July 2004**

<table>
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<tr>
<th>Boron (ppm)</th>
<th>Nemaguard</th>
<th>Lovell</th>
<th>Guardian</th>
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Alternative Rootstocks Being Tested in Stanislaus County for Almond

Krymsk 86 – Russia
Plum (Myrobalan) x peach

- 80 – 90% size of nemaguard (similar to Lovell)

• Reported to be...
  - Tolerant to heavy soils, root rot.
  - Good anchorage
  - Very little suckering
  - Appears to be very compatible with almond*
Alternative Rootstocks Being Tested in Stanislaus County for Almond

- Empyrean 1 (Barrier 1) – Italy
  Peach

- More vigorous than P / A hybrids
- Resistant to root knot nematode
- So far, very few ring nematodes in local trial
Yield (kernel pounds per acre) of Nonpareil & Carmel Almond Trees in 2010 (8th Leaf) & Cumulatively (4th – 8th Leaf).

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Specific Challenges…

- Alkaline / salty soil or water
  - P/A hybrid (not if heavy soil or ring nematodes)
    - Hansen, Nickels, Brights, Paramount,
  - Atlas (not if ring nematodes)
  - Viking
  - Empyrean 1 or Cadaman??
Specific Challenges...

- Poor drainage / heavy soil
  - Marianna 26-24
  - Krymsk 86
  - Marianna 40
  - Ishtara

More vigorous than M 26-24 with little suckering

- Hiawatha?
- Penta?
- Tetra?
- Empyrean 101?
Number of Suckers / Tree
May, 2011

- **Marianna 26-24**: 6
- **Empyean 2**: 1
- **Tetra**: 0
- **Hiawatha**: 0
- **Krymsk 86**: 0
- **Marianna 40**: 0
- **Nemaguard**: 0
- **Viking**: 0
Rootstock Effect on Tree Size of Fourth-Leaf Butte Almond Trees.
December, 2010.
Specific Challenges...

- Oak root fungus
  - Marianna 26-24 is the only known commercially available almond rootstock with ORF tolerance
Don’t ignore the bottom half of the tree!

Think about what specific challenges your ground may have and select the appropriate rootstock.

Your best offense is a good defense.

Thank you for your attention