Legumes as Orchard Floor Management in Peach

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Challenges Facing Agriculture in Utah and the Intermountain West

- Short growing season
- Cold winters and hot summers
- Arid environment
- Shallow alkaline soils
- Prime fruit growing area
- Under pressure from rapid urbanization

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**Orchard Treatments**

Peach orchards planted 2008 and 2009

<table>
<thead>
<tr>
<th>Organic orchard</th>
<th>Conventional orchard</th>
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<tbody>
<tr>
<td>In-row</td>
<td>In-row</td>
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<tr>
<td>Alley</td>
<td>Fertility</td>
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<tr>
<td>Straw mulch</td>
<td>Bare-ground</td>
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<td>Grass</td>
<td>NPK</td>
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<td>Legume</td>
<td>Compost</td>
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<td>Legume</td>
<td>Compost</td>
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<td>Tillage</td>
<td>Transition</td>
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<td>Grass</td>
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<tr>
<td>Weed Fabric</td>
<td>Grass</td>
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</tbody>
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**Organic and Integrated Peach Orchard Trial in Kaysville Utah**
**Overall Goals**

1) Determine extent to which orchard grown legumes can replace the need for external sources of fertilizer and improve soil health.

2) Develop organic production practices suited to fruit growing conditions of Intermountain West.

**Orchard Management 2008-2010**

- Varieties: Starfire and Coralstar on Lovell rootstock
- Spacing: 8 x 16ft
- Chicken and paunch manure compost: 0.6, 0.9 and 1.12 oz total N tree
- Trace elements: Albion Zinc (Zn), multi-mineral, manganese (Mn), iron (Fe), calcium (Ca), magnesium (Mg)
- Disintegrating sulfur applied in 2010 to soil 0.42lb / tree

**Orchard Management: 2011-2014**

- Compost applied to meet P needs only ~ 8lb per tree wet weight
- Feather meal applied differently per treatment
- Total N applied 0.3-0.5 lb N per tree.
- Legume biomass 0.25 lb N per tree

**Organic Pesticide Applications**

- Nordox 75WG, coryneum, spring and fall
- Stylet Oil, coryneum, spring and fall
- Dipel Pro, peach twig borer, 1-2 apps. per gen.
- M-Pede 1% solution, green peach aphids
Orchard Irrigation

Suspended irrigation lines installed 2012

Micro-sprinklers

360°, 19.8 gph (12)
180°, 10.5 gph (6)

Water applied based on soil moisture drawdown at the plot level.

Organic Orchard: Tree growth

Alleyway

Tree-row

Alleyway Effects on Yield

Tree-row Effects on Yield
In Row Weed/Living Mulch Biomass

No relationship between biomass, straw mulch, legumes in alleyway and water use.

Water use was associated with tree size.

Organic Orchard: Tree Root Distribution

- 4 cores per plot
- 0-60 cm depth
- Roots sorted in 10 cm sections
  - dry wt. cm³
  - root length density
Tree leaf nitrogen natural abundance ($\delta^{15}N$)

Soil Organic C

Total Nitrogen

Soil Microbial Biomass

Dehydrogenase Enzyme Activity
Available Soil Phosphorus

New Orchard Treatments Applied in 2016
- Mowing (M) vs Tillage (T)
- Fertilized (F) vs non-Fertilized (NF)
- 2.5lb Feathermeal 13-0-0
- Trefoil (Tr) vs Grass (G)

Lygus Bug Abundance

Catfacing Damage
Conclusions

- Organic tree growth (tillage, weed fabric and legume alleyway) equivalent to conventional
- Legumes in alley way overcomes weed competition and reduces cost of inputs
- Major pest is earwig not lygus bug
- Impact of legumes on lygus bug but not earwig
- Yields variable due to frost problems

Acknowledgements

This project is funded through the USDA OREI program, the Utah Department of Agriculture and Food Specialty Crop Block Grant program, and the Utah Agricultural Experiment Station.
Organic Soil Fertility Management

Mineralization

Immobilization

Risk Assessment

- Stochastic simulation run 1000 times

- Cumulative net returns per acre

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<tr>
<th></th>
<th>Organic</th>
<th>Eco-Friendly</th>
<th>Conventional</th>
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<tbody>
<tr>
<td>Min</td>
<td>$294,214</td>
<td>$222,985</td>
<td>$329,108</td>
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<tr>
<td>Mean</td>
<td>$221,560</td>
<td>$85,719</td>
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<tr>
<td>Max</td>
<td>$672,679</td>
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<tr>
<td>Std Dev</td>
<td>$141,120</td>
<td>$113,281</td>
<td>$216,653</td>
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<tr>
<td>CV</td>
<td>64</td>
<td>132</td>
<td>137</td>
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