Finding Cost-Effective Weed and Nutrient Management Practices in Organic Pear Orchards

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Project Funding

2009
California Pear Advisory Board

2010-11
Organic Farming Research Foundation
Results of Past Surveys

Surveys of organic growers in WA & CA:
Weed control, soil fertility are two of the top production challenges in organic tree fruit production
Experimental Methods
Trial Started Oct. 16, 2008

- Uniform Bosc block, 18’ x 10’, planted 2001
- RCB design, 7 treatments, 5 reps
- Plot size: 6 trees/rep (sample middle 4 trees)
- All 7 treatments down each row
Treatments

1. In-row mowing, no N fertilizer
2. In-row mowing, manure (low rate)
3. In-row mowing, manure (high rate)
4. In-row mowing, feather meal**
5. Landscape fabric + manure (high rate)
6. Wood chips + manure (high rate)
7. Herbicide strip + manure (high rate)

**Grower Standard
## Manure and N Rates

Low Rate Treatment

<table>
<thead>
<tr>
<th></th>
<th>Applic. Rate (Tons/Acre)</th>
<th>Total N (%)</th>
<th>Total N(^2) (lbs./A)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Oct. 2008</td>
<td>2.0</td>
<td>3.2</td>
<td>104</td>
</tr>
<tr>
<td>Oct. 2009</td>
<td>2.0</td>
<td>2.6</td>
<td>83</td>
</tr>
<tr>
<td>Apr. 2010</td>
<td>1.0</td>
<td>2.9</td>
<td>47</td>
</tr>
<tr>
<td>TOTAL</td>
<td></td>
<td></td>
<td>234</td>
</tr>
</tbody>
</table>

\(^1\)High rate = double the low rate

\(^2\)Total N based on % N and % dry weight (avg. 80%)
### Feather Meal and N Rates

<table>
<thead>
<tr>
<th>Date</th>
<th>Applic. Rate (lbs./Acre)</th>
<th>Total N (%)</th>
<th>Total N(^1) (lbs./A)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Oct. 2008</td>
<td>1,000</td>
<td>11.0</td>
<td>103</td>
</tr>
<tr>
<td>Oct. 2009</td>
<td>1,000</td>
<td>7.7</td>
<td>74</td>
</tr>
<tr>
<td>Apr. 2010</td>
<td>400</td>
<td>12.0</td>
<td>46</td>
</tr>
<tr>
<td>TOTAL</td>
<td></td>
<td><strong>223</strong></td>
<td></td>
</tr>
</tbody>
</table>

\(^1\)Total N based on % N and % dry weight (avg. 94%)
In-row mower and occasional damage
Herbicide

Not great control of grasses
Weed Pharm Rates and Prices
(Treated Acres)

- Typical grower rates (CEO, Pharm Solutions Inc.)
  - 1.5-2 gal./A/applic., 5-7 sprays/yr., 35 gal./A water
- Recommended rate (Tom Lanini, UCD)
  - Undiluted, 70 gal./A/application
- Price (275 gal. tote) $2,100 delivered, $7.60/gal.
- Price (truckload) $5,600 delivered, $6.75/gal.
- So the cost would be 70 gal. x $6.75/gal. x 0.25 (treated acreage) = $118 per orchard acre
- Weeds should be sprayed at the 4-6 leaf stage
Herbicides Used

**Vinegar** (Weed Pharm, now USDA NOP certified)
- 20% vinegar + org. surfactant (NuFilm P), 1.0% v/v

**GreenMatch** (Marrone Bio Innovations, Davis)
- d-limonene, 10% solution

- Spray volume 70 gal./treated acre
- 5 applications/year
Vinegar
Sprayed Oct., Nov. 2008
Feb., June 2009, ...

Feb. 2009

May 2009
Wood Chips

Oct. 2009, Apr. 2010
5 ft. strip, 6 in. deep
25 ft.³/tree (224 cu.
yds./acre).
Have 1% N, weigh ~600 lbs./cu. yd → about 5.6 lbs. of actual N were applied per tree, or about 1,350 lbs. N/acre
Wood Chips

Only occasional weed growth
Landscape Fabric

- 3 ft. wide/side, overlapped 8 in. (~5 ft. wide)
- Pins placed every 2 ft.
- Lasts 8 years (?)
- **Organic rules:** Annual removal once a year
Landscape Fabric

Fabric torn by mower
Organic Fertilization

**Chicken Manure**
- Usually with wood shavings, rice hulls
- Smell, $\text{NH}_3$ volatilization are major issues

**Feather Meal**
- Pelleted; slow release through season
- Little smell, little $\text{NH}_3$ volatilization
Chicken Manure

2 T/A

4 T/A
Feather Meal (Pelleted)
Results – 2009-10
No significant differences for these

- Yield (30, 26 T/A)
- Fruit diameters (2.8, 2.7 in.)
- Trunk cross-sectional area
- Leaf P, K, Ca, Mg content
- Most soil nutrients
Stem Water Potential, 2009
(Tree water stress [neg.])

Water Potential
(bars)

21-May 8-Jun 17-Jul 13-Aug

NS NS NS a a b a

Mowing Fabric Chips Herb.
Voles

No Trunk Damage Seen
Vole Holes, Oct. 2010
No. per 6 Trees (1 Side Only)
Economics
Assumptions Used

• In-row mowing 5 times per yr. (2 passes)
• GreenMatch herbicide applied 5 times
• Wood chips – Year 1: 6 in., Year 2: 3 in.
• Fabric longevity: 8 yrs.
• Chicken manure – 2 vs. 4 T/A
• Feather meal – 0.5 T/A
Economics
Total Costs/Acre/Year

NOTE: Fabric cost does not include annual removal
Conclusions

• Wood chip cost prohibitive, weeds may invade, but voles are reduced
• Fabric mulch greatly reduces weeds and it may be cost-effective (if it lasts), but requires annual removal
• Current organic herbicides don’t work well
• Manure is cheapest but availability is limited
• Organic production requires price premium
• Project to continue 1 more year