Nutrient Considerations for Olives

Joe Connell, Farm Advisor
UC Cooperative Extension Butte County

Agriculture & Natural Resources

University of California
Cooperative Extension
Olives do well on shallow soils with good drainage.
Proper Olive Nutrition

Encourages:

✓ New growth
✓ Better fruit size
✓ Heavier production
✓ More regular bearing
16 Essential Plant Nutrients

- 9 macro-nutrients needed in relatively large amounts: C, H, O, P, K, N, S, Ca, Mg
- 7 micro-nutrients are trace or minor elements that are needed in small quantities: Fe, Mn, B, Zn, Cu, Cl, Mo
In olive, we’re generally only concerned with three nutrients:

- Nitrogen
- Potassium
- Boron
Tissue & Soil Analysis

- Leaf Analysis Used:
  - To assess nutrient status
  - To develop fertilization program

- Soil Analysis Used:
  - To diagnose problems (excesses or imbalances)
Soil Analysis may also guide

✔ Soil amendment applications
  - Lime application to adjust low soil pH
  - Gypsum application to adjust Ca:Mg ratio or to reclaim alkali soils
## Leaf Analysis Levels for Olive

<table>
<thead>
<tr>
<th>Nutrient</th>
<th>Deficient</th>
<th>Optimum</th>
</tr>
</thead>
<tbody>
<tr>
<td>Nitrogen</td>
<td>1.4%</td>
<td>1.5-2.0%</td>
</tr>
<tr>
<td>Potassium</td>
<td>0.4%</td>
<td>0.8-1.0%</td>
</tr>
<tr>
<td>Boron</td>
<td>14 ppm</td>
<td>19-150 ppm</td>
</tr>
</tbody>
</table>

Sample 100 mature leaves in July from the middle of non-fruiting shoots
Where do we put fertilizer materials?

Olive has a shallow, spreading root system.

Nitrogen or Boron may be broadcast or spread in the tree row.

Potassium is banded along side the tree row.
Nutrients can be effectively injected through drip irrigation.
Nitrogen

Low nitrogen symptoms.....

- Small, yellowish leaves
- Poor shoot growth
- Sporadic bloom
- Poor fruit set
Low N = Pale color, lack of new growth
Adequate N is necessary for good bloom, fruit set, and yield.
# Nitrogen Rate vs. Yield & Size

**Mission Olives, Palermo, Heavy Crop Year**

<table>
<thead>
<tr>
<th>TREATMENT</th>
<th>YIELD PER TREATMENT</th>
<th>% CANNING SIZE</th>
</tr>
</thead>
<tbody>
<tr>
<td>3 lbs. ACTUAL N</td>
<td>226 lbs.</td>
<td>43</td>
</tr>
<tr>
<td>1 lb. ACTUAL N</td>
<td>196 lbs.</td>
<td>63</td>
</tr>
<tr>
<td>1/2 lb. ACTUAL N</td>
<td>172 lbs.</td>
<td>92</td>
</tr>
<tr>
<td>UNFERTILIZED</td>
<td>49 lbs.</td>
<td>97</td>
</tr>
</tbody>
</table>

Source: H.T. Hartmann, UC Davis
## Nitrogen-Containing Fertilizers

*To supply an equal amount of actual $N*$

<table>
<thead>
<tr>
<th>Fertilizer</th>
<th>% NITROGEN</th>
<th>1 lb. ACTUAL N</th>
</tr>
</thead>
<tbody>
<tr>
<td>UREA</td>
<td>46-0-0</td>
<td>2 1/4 lbs.</td>
</tr>
<tr>
<td>AMMONIUM NITRATE</td>
<td>33-0-0</td>
<td>3 lbs.</td>
</tr>
<tr>
<td>AMMONIUM NITRATE SULFATE</td>
<td>21-0-0</td>
<td>5 lbs.</td>
</tr>
<tr>
<td>CALCIUM NITRATE</td>
<td>16-0-0</td>
<td>6 1/3 lbs.</td>
</tr>
</tbody>
</table>
Maintaining Nitrogen Levels

- with inorganic nitrogen sources is easy

- Broadcast 50-100 lbs. N/acre/year (1-2 lbs. per tree at 48 trees/acre)
- Soil applied in January
- Benefits flower bud development and spring growth
- If split between January and October may help moderate alternate bearing
Biological nitrogen sources

Legumes.... fix N biologically

- Legumes provide nitrogen and release it slowly over time—weeks to months
- Require additional water
- Require mowing to control growth
- Gopher populations will increase
- May improve water penetration
- No other nutrients are provided

Roland D. Meyer, Extension Soils Specialist
University of California Cooperative Extension
LAWR Dept., Davis, California
Seeding a sub-clover cover crop (15-30 lbs. seed/acre) with a no-till drill.

Legume Cover Crops --- annual sub-clovers work well
Mow and throw clippings into the tree row to concentrate recycling of nutrients where the heaviest concentrations of roots are located.
When can the tree use nitrogen most efficiently?

- For highest uptake by the tree, nitrogen should be in the root zone just before the period of greatest uptake.
  - In olive, this is just ahead of shoot growth and bloom in the early spring.
- Mow a sub-clover cover crop when 4-7 inches more rainfall is expected so that nitrogen is moved from the clippings into the soil but not leached too deeply or lost to runoff.

Roland D. Meyer, Extension Soils Specialist
University of California Cooperative Extension
LAWR Dept., Davis, California
So.....What are potential benefits of additional organic matter?

- Can aid water infiltration
- Helps develop soil structure
- Provides larger reservoir for nitrogen and other micro-nutrients
Challenges - - - with higher organic matter

✓ Larger reservoir for nitrogen must be managed year round OR nitrates can be leached to groundwater or can runoff
✓ When a cover crop is grown, it will use additional water
✓ OM can reduce herbicide effectiveness
Potential Nitrogen losses

- Volatilization of ammonia
- Denitrification
- Leaching

Roland D. Meyer, Extension Soils Specialist
University of California Cooperative Extension
LAWR Dept., Davis, California

Fig. 1.5. Fates of nitrogen in the soil.
Potassium Deficiency

- Dead leaf tips or margins
- Light green leaf color
- Twig dieback
Tree response to potassium fertilizer ---

<table>
<thead>
<tr>
<th>Yield</th>
<th>% Canning Fruit</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>4 yr Avg</td>
</tr>
<tr>
<td>K&lt;sup&gt;+&lt;/sup&gt; Mass Dose</td>
<td>152</td>
</tr>
<tr>
<td>Unfertilized</td>
<td>36</td>
</tr>
</tbody>
</table>

Source: H.T. Hartmann, UC Davis

- Deficiency = less crop & smaller fruit size
Correcting Potassium Deficiency

✓ Apply 10-20 lbs potassium sulfate per tree (500-1000 lbs per acre) [non-synthetic, Great Salt Lake Minerals]

✓ Ringed or BANDED at drip line, NOT broadcast


✓ Good for several years
Boron Deficiency ---

- Twig dieback and excessive branching
Boron Deficiency ---

- Leaves w/ dead tips, a yellow band, but still green at the base.
Boron Deficiency

- Defective fruit, a “monkey face” symptom
- Premature fruit drop
Correcting Boron Deficiency

- Broadcast ½ to 1 lb. of a 14-20% borax material per tree on the soil surface (25-50 lbs. per acre)
- Apply in winter, good for several years
- Organic restrictions: soil deficiency must be documented by testing
Joe Connell, Farm Advisor
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