Plant Tissue Sampling in Orchards and Vineyards

Patricia Lazicki and Daniel Geisseler

Background

- Plant analyses are useful for diagnosing nutritional problems and monitoring the fertilization program. Tissue testing is most effective when used together with nutrient budgets and observations of orchard performance \([^{5,12}]\).

- Nutrient concentrations change over the season and also differ between plant parts \([^{4}]\). It is therefore important to sample the correct plant part, and at the time for which the test was calibrated (Table 1). For information on optimal nutrient concentrations see the fertilization guidelines for the different crops (https://apps1.cdfa.ca.gov/FertilizerResearch/docs/Guidelines.html).

- Archiving the results from the analyses allows managers to track changes in the orchard over time.

General Sampling Instructions

- Nitrogen changes more quickly in the plant and the soil than other nutrients, so leaf N should be tested every year for most crops. Other nutrients may be taken less often, except in deficiency-prone crops (Table 1).

- Divide the orchard into management areas with similar characteristics and take a separate sample from each area. For example, areas with trees of different varieties, ages or under different types of irrigation should be sampled separately \([^{5,12}]\).

- Randomly select healthy trees throughout the orchard or management area and sample the correct plant parts (See Table 1).

- Do not take samples from dead, diseased, insect damaged, or mechanically injured plants, or plants in border areas. To determine the cause of a suspected deficiency, separate samples may be taken from the poorly performing area and from adjacent similarly managed healthy plants \([^{8,11}]\). This may be done at any time of year \([^{9}]\).

- If leaves have been sprayed with N or K they should not be sampled for at least a week. Do not analyze leaves that have been sprayed with micronutrients for those nutrients \([^{5}]\).

- Collect the specific plant parts and place them into a clean paper bag \([^{5}]\). Samples can mold in plastic bags \([^{6}]\).

- Samples that will be analyzed for micronutrients should be washed with water containing a little detergent, and rinsed once with tap water and twice with distilled water. Samples for N, P or K analysis don't need to be washed \([^{5}]\).

- Clearly label the bag and provide the information required by the test lab. Follow the lab’s instructions for packaging and shipping.

- Deliver the samples immediately to the lab or use a one-day delivery service. If immediate delivery is not possible, refrigerate until they can be sent \([^{5,11}]\).
Table 1: Sampling procedure for California orchard and vineyard crops

<table>
<thead>
<tr>
<th>Plant</th>
<th>Sampling date</th>
<th>Plant part</th>
<th>Plants to sample</th>
<th>Total parts needed</th>
<th>Notes</th>
</tr>
</thead>
<tbody>
<tr>
<td>Almond</td>
<td>36-48 days after full bloom</td>
<td>Leaves from non-fruiting, well-exposed spurs 5-7 feet above the ground</td>
<td>18-28 trees (&gt;30 yards apart)</td>
<td>Leaves from 5-8 spurs per tree</td>
<td>Tested with Nonpareil almonds. Predicts all nutrients in July leaves (traditional method uses the same sampling protocol). Boron status better correlated with hulls of mature almonds at harvest.</td>
</tr>
<tr>
<td>Avocado</td>
<td>Aug-Oct</td>
<td>Terminal leaves from non-flushing, non-fruiting spring flush shoots (5-7 months old), 3-5 feet above the ground</td>
<td>&gt;10 trees per block</td>
<td>4 leaves per tree (one from each quadrant)</td>
<td>Avocado leaf testing methods adapted from citrus. Currently not very reliable. Combine with tree vigor observations.</td>
</tr>
<tr>
<td>Citrus</td>
<td>Sept-Oct</td>
<td>Terminal leaves from non-flushing, non-fruiting spring flush shoots (5-7 months old), 3-5 feet above the ground</td>
<td>&gt;10 trees per block</td>
<td>4 leaves per tree (one from each quadrant)</td>
<td>Recommended block size 5-10 acres</td>
</tr>
<tr>
<td>Grapevine</td>
<td>Full bloom</td>
<td>Petioles of leaves opposite flower clusters</td>
<td>25-50 vines</td>
<td>One or two petioles per vine</td>
<td>Petiole nitrate varies widely between rootstocks and varieties. Analyses are best used in combination with observations of tree vigor.</td>
</tr>
<tr>
<td>Olive</td>
<td>July</td>
<td>Mature mid-shoot leaves from non-fruiting, current-season shoots</td>
<td>30-40 trees</td>
<td>80-100 leaves</td>
<td>Deficiencies uncommon; N may not need to be tested annually if normally sufficient</td>
</tr>
<tr>
<td>Peach and Nectarine</td>
<td>Jun-Jul</td>
<td>Mid-shoot leaves from moderately vigorous current-season shoots</td>
<td>30-50 trees</td>
<td>60-100 leaves</td>
<td>Used to predict summer N and K levels. Pistachios are susceptible to K deficiency; samples may need to be taken every year.</td>
</tr>
<tr>
<td>Pistachio</td>
<td>30-45 days after full bloom</td>
<td>Leaves from non-fruiting, exposed branches 6-7 feet from the ground</td>
<td>At least 18 trees, (&gt;25 yards apart)</td>
<td>10 leaves per tree</td>
<td>Traditional sampling time for all nutrients. Spring analyses can predict summer N and K.</td>
</tr>
<tr>
<td>Pistachio</td>
<td>Jul-Aug</td>
<td>Fully expanded sub-terminal leaflets from non-fruiting branches, ~6 feet from the ground</td>
<td>10-20 trees</td>
<td>4-10 leaves per tree</td>
<td>Recommended maximum block size 40 acres. Prunes are susceptible to K deficiency; samples may need to be taken every year.</td>
</tr>
<tr>
<td>Prune and plum</td>
<td>July</td>
<td>Fully expanded leaves from non-fruiting spurs 5-7 feet above the ground</td>
<td>&gt;25 trees per block</td>
<td>One or two leaves per tree</td>
<td>Recommended maximum block size 40 acres. Prunes are susceptible to K deficiency; samples may need to be taken every year.</td>
</tr>
<tr>
<td>Walnut</td>
<td>Jun-Jul</td>
<td>Terminal leaflets from fully expanded spur leaves, 5-8 feet above the ground, from around the tree</td>
<td>5-10 trees</td>
<td>50 leaves</td>
<td></td>
</tr>
</tbody>
</table>
References


Daniel Geisseler is an Extension Specialist in the Department of Land, Air and Water Resources at the University of California, Davis.

Patricia Lazicki is an Assistant Specialist in the Department of Land, Air and Water Resources at the University of California, Davis.

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This document is available online at https://apps1.cdfa.ca.gov/FertilizerResearch/docs/Orchard_Tissue_Sampling.pdf

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