A collaboration between:

Plant Tissue Sampling in Orchards and Vineyards

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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 [4,12].
- 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

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

Sources: Almond [7,13], avocado [3,8], citrus [8], grapevine [6], olive [9], peach and nectarine [9], pistachio [2], prune and plum [11], walnut [1].

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The document has been prepared within the project “Assessment of Plant Fertility and Fertilizer Requirements for Agricultural Crops in California”, funded by the California Department of Food and Agriculture Fertilizer Research and Education Program (FREP).

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

Last update: June, 2016