

Soil Sampling in Orchards

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Soil assessment before planting

Planting an orchard is a large investment. For this reason, it is important to thoroughly assess soil properties before the orchard is established. The costs for an in-depth assessment of soil properties are much lower than the costs accruing from planting an orchard at an inappropriate site^[4]. Soil sampling before planting serves three major purposes:

- Determine soil properties such as pH, texture, nutrient availability, or salinity.
- Identify unsuitable areas due to physical barriers to root growth or drainage.
- Assess the variability in soil properties within the field to develop nutrient management plans.

Sampling procedure

- Divide each field into blocks based on soil survey data, slope, or cropping history^[3].
- Soil survey data provide an overview of soil properties. A convenient way to gain access to soil survey data is to use the interactive application SoilWeb (available at <http://casoilresource.lawr.ucdavis.edu/soilweb/>). For Figure 1, the application was used for a field near Davis, CA. For this field, separate samples should be taken from the area with Brentwood silty clay loam (BrA) and from the area with Myers loam (Ms). The central and right section of the field should be sampled separately if their management history differed.
- Even when a field appears to be uniform, it is worth dividing it into several blocks which are sampled and analyzed separately. Ideally, a field is divided into blocks of 2-5 acres and a composite sample of five cores

from each block is taken^[1, 3]. When larger blocks are samples, 15 to 30 cores should be taken from each block for a composite sample^[1, 8].

- When soil survey data suggest possible physical limitations, a series of backhoe pits should be dug to identify textural changes and layers that restrict root growth and drainage. This information helps to determine the best method of soil modification and whether the site is suitable at all for orchards. As an alternative to backhoe pits, undisturbed soil cores may be taken with a soil probe^[4].

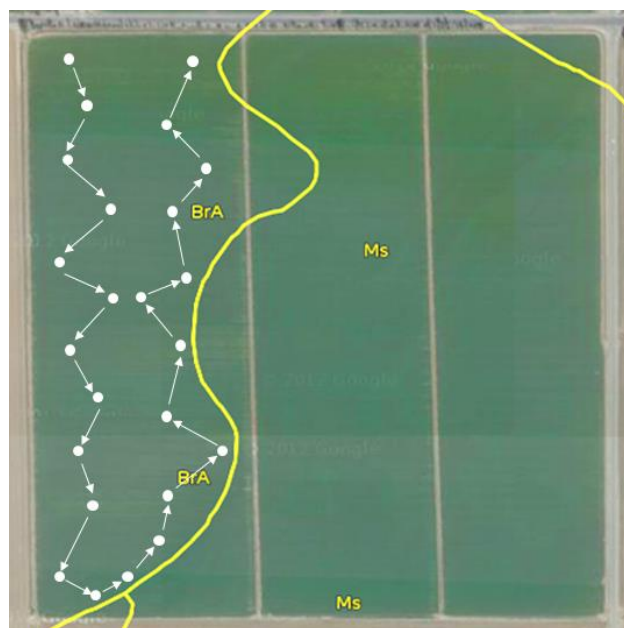


Figure 1: Soil sampling plan for a representative sample from a field or management area. The Picture is a screenshot of a field from Google map using the SoilWeb application.

- Soil sample cores are taken from the entire field or management area in a W-shaped sampling pattern or by walking a zigzag course around or through the area as shown in Figure 1 for the Brentwood soil ^[8].
- Mix the cores thoroughly; remove large stones, pieces or roots and other foreign material ^[1, 8].
- Sample by foot increments to a depth of 2 to 4 feet or deeper if restrictive layers may be encountered in the subsoil.
- Map the field based on soil survey data and the results from the soil analyses of the different blocks. This map will help to determine the blocks for soil and tissue samples in the following years.

Sampling in established orchards

Time of sampling

- Soil samples to determine the availability of potassium, phosphorus, micronutrients and salt content can be taken any time of the year. However, fall sampling is usually preferred as it allows for enough time to adjust the fertilization program for the following year ^[6].
- Taking soil samples every 3-5 years is usually adequate. In recently planted orchards, annual sampling may be done until the soil fertility program is established ^[6].
- To monitor available nutrients over the years, samples should always be taken during the same season, but preferably in fall.
- For soil nitrate analyses, samples should be taken in spring/early summer before the period of high nitrogen uptake by the trees. Samples also to be taken every year, as the nitrate content in the soil is very variable (see Factors Affecting Soil Nitrate Concentrations in spring; available online at http://apps.cdfa.ca.gov/frep/docs/Soil_Nitrate.pdf).
- Samples need to be taken before fertilizer is applied.

Sampling procedure

- Divide each field into blocks based on soil survey data, slope, cropping history, variety, rootstock, age, growth pattern, or irrigation system ^[8].

- Plant residue from the sample spot is removed ^[8].
- Samples are best taken with a soil probe or auger.
- The sample is taken halfway between the trunk and the drip line and within the wetting zone of the sprinkler/emitter (Figure 2) ^[6].
- Cores are taken from the entire area of the field or management area in a W-shaped sampling pattern or by walking a zigzag course around or through the area as shown in Figure 1 for the Brentwood soil ^[8].
- Mix the cores thoroughly; remove large stones, pieces or roots and other foreign material ^[1, 8].
- Sample by foot increments to a depth of 2 feet. When diagnosing a problem, deeper cores may be recommended ^[8].
- To obtain an accurate estimate of the nutrient availability, between 15 and 20 cores should be taken from each block for a composite sample ^[8].

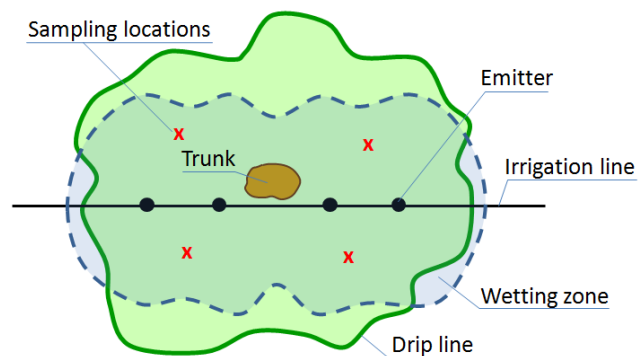


Figure 2: Bird's view of the optimal sampling location under orchard trees. Soil samples are taken within the wetting zone halfway between the trunk and the drip line.

- One sample per tree is generally taken. Within each block, make sure to sample different orientations relative to the trunk.
- Collect the samples in a clean plastic bucket^[9]. Galvanized or rubber buckets may contaminate samples with zinc^[7].

Informative videos explaining each step of the sample procedure can be found online at http://fruitsandnuts.ucdavis.edu/pages/soil_videos/

Sample handling

- When all the cores for an area are taken, mix them thoroughly^[8].
- Very wet samples should be air-dried before packaging^[2]. Do not dry the samples in an oven or at abnormally high temperature^[7].
- Put about one quart of soil in a clean bag and label it clearly. Follow the instructions of the laboratory that will do the analysis^[8].
- To receive accurate fertilizer recommendations, the sample information sheet needs to be filled out carefully^[7]. Include the information sheet within the package submitted to the test lab^[2, 5].

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

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