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Soil Fertility Guide

MARYLAND DEPARTMENT OF AGRICULTURE

Mo Cu S K Co B Mn
Ca P Fe Zn N Mg Cl

PF-2

TISSUE AND SOIL SAMPLING FOR PERENNIAL FRUIT CROPS

Introduction

Sample collection is an important part of developing a nutrient recommendation. Nutrient recommendations for fruit crops are based on soil test results, or plant tissue analyses in conjunction with soil test results, depending on the life cycle stage of the planting. Obtaining a representative sample is a critical part of maintaining the health of the plant.

In order to obtain a representative sample, it is important to collect a sample

- randomly;
- from a designated management unit or block;
- of adequate size; and
- at the appropriate time during the growing season (for plant tissue samples).

Proper sampling procedures will be discussed in greater detail to ensure a strong foundation on which nutrient recommendations can be developed.

Definition of a "Block"

When collecting plant tissue and soil samples, it is important to identify the area that will be sampled. Orchards are typically divided into management units called **blocks**. A block is defined as an area within an orchard that

- consists of plantings of the same age and species;
- has the same or similar soil types; and
- can be managed as one unit.

Figure 1 on page 2 illustrates the characteristics used to separate an orchard into blocks.

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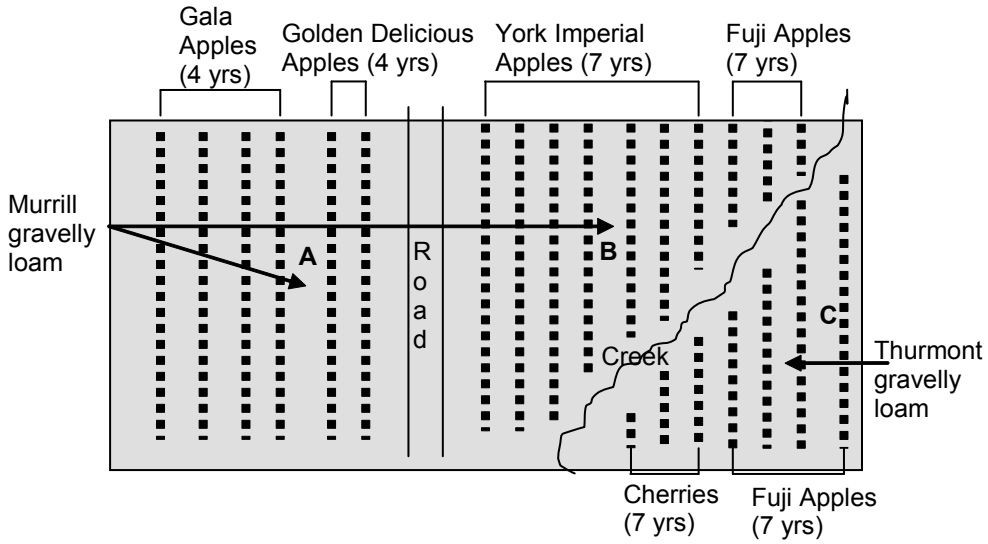

Figure 1. Characteristics that determine a block

Interpretation of Figure 1

Block A consists of 2 different cultivars of apples, of the same age, planted in the same soil type. Block A is managed separately from Blocks B and C because of the age of planting.

Block B consists of 2 different cultivars of apples, of the same age, planted in the same soil type. Blocks A and B are separated because of the age of plantings. Block B is managed separately from Block C because of soil type.

Block C consists of 2 different species of fruit trees, of the same age, on a different soil type than Blocks A and B. Since there is a small number of cherry trees in this block, there is no need to subdivide Block C any further.

Plant Tissue Sampling

Collecting a representative plant tissue sample is a critical step in determining the nutrient needs of a plant. A tissue analysis is only as good as the sample that was submitted, so it is important to perform this task correctly. The following sampling tips are provided to ensure that the best possible tissue sample is collected.

Sampling Tip #1: A plant tissue sample should be collected from each block of bearing trees. A block may consist of more than one species or cultivar. Therefore, choose the most important cultivar of the dominant species for sampling.

For example, refer to Figure 1 above. Three blocks are identified (Block A, Block B and Block C). A plant tissue sample must be collected from each block.

- In **Block A**, the orchard manager chose to sample the Gala apple trees because they are greater in number and are more economically valuable for his fresh market business.

- In **Block B**, the York Imperial apple trees were sampled because of their greater number and their value as a processing apple.

- In **Block C**, samples were collected from the Fuji apple trees because of their greater number.

Sampling Tip #2: Plant tissue samples should be collected at least every 3 years in bearing blocks. If a problem exists, samples should be taken annually until the problem is corrected.

Sampling Tip #3: For the purpose of plant tissue analysis for developing nutrient recommendations, only healthy trees should be sampled. Avoid sampling trees that show signs of disease as this may skew the results.

Sampling Tip #4: Plant tissue samples should not be collected from young, non-bearing trees.

Sampling Tip #5: Samples should be collected randomly from many different trees. Figure 2 illustrates two methods used for random sample collection.

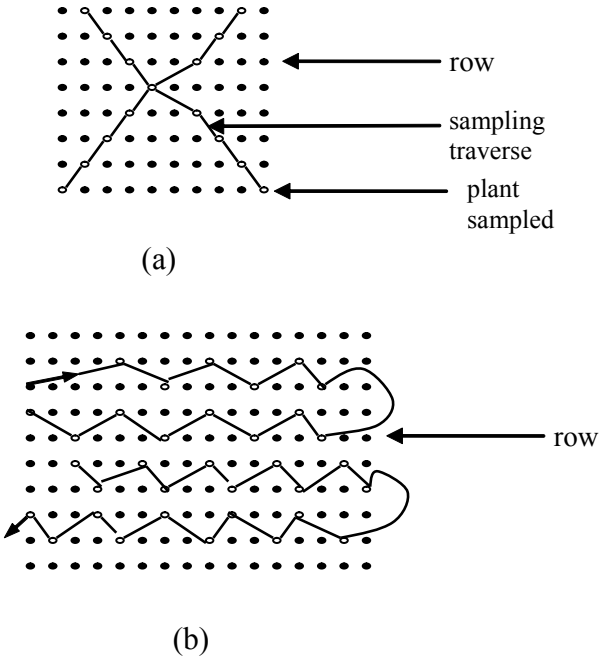

Figure 2. Sampling patterns for collecting representative samples (© Australasian Soil and Plant Analysis Council Inc. 1997; Modified from p. 78 in *Plant Analysis: An Interpretation Manual* (DJ Reuter et al.), with permission from CSIRO Publishing, Melbourne Australia - http://www.publish.csiro.au/pid/437.htm)

Sampling Tip #6: Collect the appropriate number of samples, from the appropriate plant part for the species you are sampling. Table 1 lists the plant part to be sampled, number of samples required, and the growth stage for sampling of various plant species. In addition, Figure 3 below shows the appropriate sampling location for fruit trees.

Table 1. Soil and tissue testing summary for each life cycle stage

Crop	Time to Sample	Number of Samples/Plant Part	Location on Plant
Blueberries	1st week of harvest	40 leaves (detach petioles)	Current season's growth
Brambles	Aug 1st – Aug 20th	60 leaves (detach petioles)	Select the most recent fully expanded leaf blade of each primocane.
Fruit Trees	Jul 15th – Sept 1st	50 leaves and petioles	Select shoots at eye level from around outside of the tree. Select shoots that make a vertical angle of 45-60 degrees to the ground. Remove 1 or 2 leaves from the mid-portion of the current season's growth. (See Figure 3.)

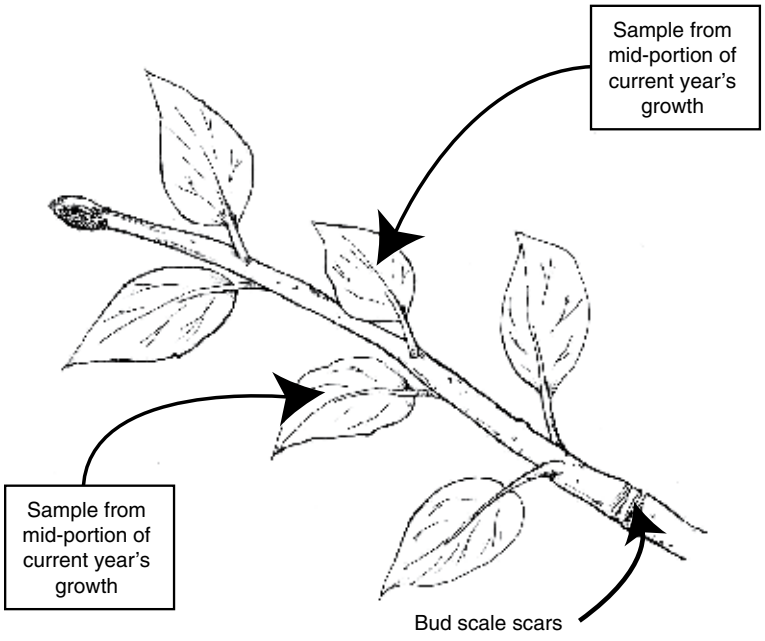

Figure 3. Proper sampling locations for fruit trees (drawn by Pete Mazzocchi, Senior Graphic Designer, College of AGNR, UMCP)

Sampling Tip #7: It is essential to collect tissue samples during a time period that is consistent with the sampling time used to develop the interpretive guidance for that plant. This is the time when nutrient levels are most stable in plant tissue. Figure 4 illustrates the seasonal fluctuation of two nutrients, nitrogen and calcium, in a tissue sample and identifies the appropriate sampling period, when levels of nitrogen and calcium are relatively stable.

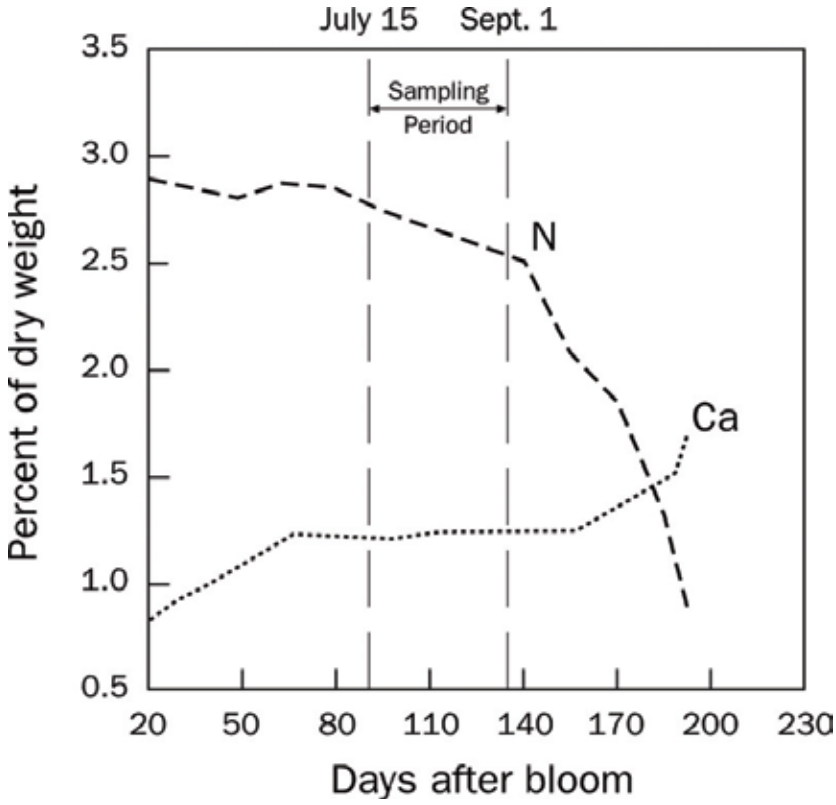

Figure 4. Seasonal fluctuation in nitrogen and calcium content of apple leaf tissue samples (drawn by Margaret Weickert, Department of Business Services, UMCP; from information in Westwood, 1993)

Processing Tissue Samples for Shipment

Samples should be placed in a paper bag during collection and shipment. The bag should be clearly labeled with the block name, species, and cultivar sampled. The bag should be left open to allow the samples to air dry for several days prior to shipment to prevent them from molding. Some laboratories may follow other procedures so check with the selected laboratory and be sure to follow its procedures.

The lab's sample request form should be completed and included with the shipment. Confirm that the information on the request form is consistent with the information on the sample bags to avoid any confusion at the testing laboratory.

Soil Sampling

Soil sampling frequency in orchards varies depending on the life cycle stage. Table 2 lists the soil sampling frequency for the three life cycle stages.

Table 2. Soil sampling frequency for various life cycle stages

Life Cycle Stage	Sampling Frequency
Pre-plant	Up to 2 times • Prior to biorenovation • Prior to tree establishment
Non-bearing	Do not sample
Bearing	At least every 3 years

In bearing blocks, soil samples should be collected from each block and from the same general area (around the same cultivar) where plant tissue samples were collected. Soil and plant tissue samples should be collected in the same year; however, soil samples are not affected by seasonality and can be taken at a time when soil conditions are more conducive to collecting a representative sample (for example after a rain when the soil is less hard).

As with tissue samples, soil samples should be collected randomly throughout the block. Refer to Figure 2 on page 3 to view sampling patterns. They should also be collected at the proper depth (see Figure 5 below).

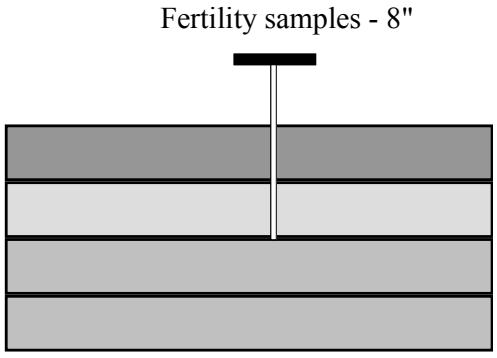

Figure 5. Correct soil sampling depth for fertility samples

Once the soil samples have been collected, they must be properly processed for shipment. Table 3 on page 7 outlines the steps necessary to properly collect a soil sample and prepare it for shipment to a soil test lab of your choice.

The lab's sample request form should be completed and included with the shipment. Confirm that the information on the request form is consistent with the information on the sample bags to avoid any confusion at the testing laboratory.

Table 3. Collecting a soil sample and preparing it for shipment

Step	Action
1	Collect 15-20 samples from each block at a sampling depth of 8 inches to form the composite sample.
2	Mix the sample thoroughly and collect a sub-sample (approximately 1 pint of soil) by taking a scoop of soil from different areas of the composite sample.
3	Allow the sub-sample to air dry thoroughly before placing it in a clearly labeled sample bag. **Note:** The bag should be labeled with enough information so that it can be easily matched to the tissue samples taken from the block.

Summary

Analyses from representative soil and plant tissue samples are essential components to consider when making nutrient recommendations for perennial fruit crops. For bearing crops, soil and plant tissue samples should be collected in the same production year; however, it is not necessary to collect samples at the same time. Soil samples could be collected when the soil conditions are more conducive to collecting a representative sample (for example after a rain when the soil is less hard).

Table 4 summarizes the various life cycle stages and the analyses that should take place at each stage.

Table 4. Soil and tissue testing summary for each life cycle stage

Stage of Planting	Soil Analysis	Plant Tissue Analysis
Biorenovation	Yes	No
Pre-plant	Yes	No
Non-bearing	No	No
Bearing	Yes	Yes

References

Reuter, D. J. and J. B. Robinson. 1997. *Plant Analysis: An Interpretation Manual* (2nd edition). CSIRO Publishing.

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Westwood, M. N. 1993. *Temperate-Zone Pomology: Physiology and Culture* (3rd edition). Timber Press.

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