SAMPLING FOR PLANT ANALYSIS

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Sample collection is critical for plant analysis as plant nutrient composition varies with age, the portion of the plant sampled, and many other factors. Mistakes or carelessness in selecting, collecting, handling, preparing, or shipping plant tissue for analysis can result in unreliable data, which may lead to incorrect interpretations and recommendations. Standards, against which the sample is evaluated, have been selected to represent the plant part and time of sampling that best define the relationship between nutrient composition and plant growth. Deviation from the prescribed protocol severely limits this interpretations capability. It is, therefore, critical to follow a standard sampling procedure.

When and How to Sample Plants

Table 1 and Figure 1 outline the proper stage of growth, plant part, and number of plants to sample for major agronomic and horticultural crops. Similar information is depicted in figures on the last page of this publication. If a crop is sampled at other times in the growing season, the analysis will be provided but may not be interpreted on the University of Wisconsin plant analysis report. However, when plant analysis is being used to confirm a suspected nutrient deficiency, the samples should be taken as early int he season as possible so that the deficiency can be corrected and minimize the potential yield loss. Plants showing abnormalities usually continue to accumulate nutrients even if growth is impaired by some limiting factor.

Samples should not be taken from plants that obviously have been stressed from causes other than nutrients. Do not take samples from plants that —

- Are dead or insect damaged;
- Are mechanically or chemically injured;
- Have been stressed by too much or too little moisture (i.e., flooding or drought);
- Have been stressed by abnormally high or abnormally low temperature.

Sample Normal and Abnormal Areas

When a nutrient deficiency is suspected (even without visual symptoms), or there is a need to compare different areas in a field, it is recommended that similar plant parts be collected separately from both the affected plants and adjacent normal plants that are at the same stage of growth. In this way, a better evaluation can be made between the nutritional status of healthy and abnormal plants of the same variety grown under the same conditions.

Table 1. Recommended sampling stage of growth, plant part, and sample size for diagnostic plant tissue analysis.

Crop	Stage of growth	Plant part	No. of plants to sample
		Field Crops	
alfalfa	bud to first flower	top 6 inches	35
alfalfa, hay	harvest	whole plant	25
barley	prior to heading	newest fully developed leaf	50
bean, dry	prior to or at initial flower	newest fully developed leaf	25
bean, lima	prior to or at initial flower	newest fully developed leaf	25
bean, snap	prior to or at initial flower	newest fully developed leaf	25
bluegrass	prior to heading	newest fully developed leaf	50
bromegrass	prior to heading	newest fully developed leaf	50
buckwheat	boot stage	whole plant	20
canary grass	prior to heading	newest fully developed leaf	50
canola	flowering	mature upper leaves	25
corn, field	12 inches tall	whole plant	20
corn	pre-tassel	leaf below whorl	15
corn	tassel to silk	ear leaf	15
corn, silage	ensiled or chopped	whole plant	2 qt
corn, sweet	tassel to silk	ear leaf	15
corn, pop	tassel to silk	ear leaf	15
fescue, fine	new summer growth	clippings	50
lupine	early flower	whole plant	25
millet	4 weeks after clipping	whole plant	25
mint	flowering	whole plant	25
oat	prior to heading	whole plant	50
orchard grass	prior to heading	newest fully developed leaf	50
pea, canning	prior to or at initial flower	newest fully developed leaf	25
pea, chick, field	prior to or at initial flower	newest fully developed leaf	25
potato	prior to or at initial flower	4th petiole & leaflet (whole lvs)	40
potato	tuber bulking	4th petiole & leaflet (whole lvs)	40
potato	prior to or at initial flower	4th petiole from top	50
potato	tuber bulking	4th petiole from top	50
red clover	bud to first flower	top 6 inches	35
red cover hay	harvest	whole plant	25
rice, wild	prior to heading	newest fully developed leaf	50
rye	prior to heading	newest fully developed leaf	50
sorghum, grain	prior to heading	2nd fully developed leaf	20
sorghum-sudan	prior to heading	newest fully developed leaf	50
soybean	prior to or at initial flower	newest fully developed leaf	25
sugar beet	prior to or at initial flower	newest fully developed leaf	25

Table 1. (continued).

Crop	Stage of growth	Plant part	No. of plants to sample
sunflower	florets about to emerge	newest fully developed leaf	20
tobacco	45 to 60 days after planting	newest fully developed leaf	15
tobacco	early flower	newest fully developed leaf	15
tobacco	mature	leaves	15
trefoil, birdsfoot	bud to first flower	top 6 inches	35
triticale	prior to heading	newest fully developed leaf	50
vetch, crown	bud to first flower	top 6 inches	35
wheat	tillering	newest fully developed leaf	50
wheat	prior to heading	newest fully developed leaf	50
Vegetable Crops			
asparagus	mature fern	fern 17 to 35 inches up	20
beet, red	mid-season	youngest mature leaves	20
broccoli	heading	youngest mature leaves	20
brussels sprouts	heading	youngest mature leaves	20
cabbage	mid-season	wrapper leaves	20
carrot	mid-season	youngest mature leaves	20
cauliflower	mid-season	youngest mature leaves	20
celery	mid-season	youngest mature leaves	20
cucumber	prior to or at early fruit development	youngest mature leaves	20
ginseng	mid-season	youngest mature leaves	35
lettuce	mid-season	wrapper leaves	20
melon	prior to or at early fruit development	newest fully developed leaf	25
muskmelon	prior to or at early fruit development	newest fully developed leaf	25
onion	mid-season	tops, no white portion	20
pepper	prior to or at early fruit development	petiole and leaflet	40
pumpkin	prior to or at early fruit development	newest fully developed leaf	25
spinach	mid-season	newest fully developed leaf	25
squash	prior to or at early fruit development	newest fully developed leaf	25
tomato	mid-season	newest fully developed leaf	40
watermelon	prior to or at early fruit development	newest fully developed leaf	25

Table 1. (continued).

Crop	Stage of growth	Plant part	No. of plants to sample
		Fruit Crops	
apple	current season's shoots (1-15 July)	fully developed leaf at mid-point of new shoots	4 lvs
blueberry	new summer growth	fully developed leaves	35
cherry, sour	current season's shoots (1-15 July)	fully developed leaf at mid-point of new shoots	4 lvs
cranberry	15 Aug to 15 Sept	current season growth above berries	200 uprights
grape	full bloom	newest fully developed petiole	5 from each of 10 vines
raspberry	10 Aug to 4 Sept	6th and 12th leaf blade and petiole from tip	2-3 lvs from 10 canes
strawberry	at renovation before mowing	fully developed leaflets and petioles	40

Plant Tissue Sample Preparation

After a plant sample has been collected, it should be prepared for shipment or delivery to the laboratory. Roots or foreign material attached to the sample should be removed and discarded. Plant tissue must then be dusted off to remove soil particles. DO NOT WASH tissue since soluble nutrients will be leached out of the sample.

If tissue is to be mailed, the sample should be air-dried above a heating vent or in the sun for one to two days to avoid mold formation during shipment. Place the plant sample in a paper bag in a large paper envelope for shipment. Do not pack the sample tightly into the mailing container or put samples in plastic or polyethylene bags as this will also promote mold development. Plant samples that are delivered to the laboratory do not need to be air-dried if they are delivered within one day after sampling. Samples to be delivered directly to the laboratory at a later date may be kept frozen or air-dried until they are delivered.

Include Soil Sample

Soil test results for pH, organic matter, phosphorus, and potassium (routine test) can be useful for correlating with plant analysis results to pinpoint a nutrient problem. A composite soil sample, consisting of five or more cores, taken to a depth of 6-7 inches, should be taken from the same area where the plant sample was collected. For row crops, avoid the fertilizer band by sampling from the middle of the row. Put the sample into a soil sample bag or other waterproof container and label the soil sample with the same field and sample number as that assigned to the

tissue sample. Package corresponding plant and soil samples together, but make certain soil sample bags do not open in transit as spilled soil will contaminate plants. No additional fee is charged for routine soil analysis when submitting along with a plant sample. Special soil test requests for Ca, Mg, S, B, Mn, or Zn are assessed an extra fee. For further details on proper soil sampling procedures, refer to UWEX Publication A21, "Sampling Soils for Testing."

What to Do With Samples

A "Plant Analysis Information Sheet" should be filled out for any samples submitted. Use a separate information sheet for each sample. Plant samples, corresponding soil samples, and accompanying information sheets can be obtained and turned in at your County Extension Office. Samples may also be sent or delivered to the laboratory directly. The University of Wisconsin laboratory that conducts the plant analysis program is the Soil and Plant Analysis Laboratory at Madison. The address and telephone number is:

UW Soil and Plant Analysis Laboratory
8452 Mineral Pt. Rd.
Verona, WI 53593-8696
608-262-4364

Some, but not all, private laboratories also analyze plant tissues; therefore, you should check with your laboratory on the specific services they provide before submitting the samples.

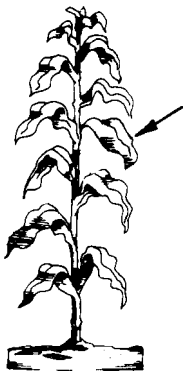
What the Analysis Report Will Include

The report will show the concentration of N, P, K, Ca, Mg, S, Zn, Mn, B, Cu, Fe, Al, and Na in the plant sample. If a soil was submitted with the plant sample, soil analyses for pH, organic matter, P, K, and any special soil test results will also be reported. In addition, the analytical levels of nutrients in the plant and soil will be interpreted to reflect nutrient deficiencies, toxicities, or imbalances by the sufficiency range approach, and if calibration data are available, the nutrient ratio method. When warranted, fertilizer recommendations will be made based on the analytical results. Most commonly grown field vegetables and fruit crops will receive these interpretations and recommendations. For those plant materials where calibration data are not available, these analytical results will be provided without interpretation.

Corn

Seedling

Sample entire above ground portion of 20 plants.



Prior to tesseling

Sample fully developed leaf below the whorl. Sample 15 plants.

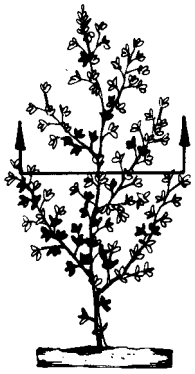
Tasseling through silking

Sample ear leaf or leaf opposite and below ear. Sample 15 plants.

Alfalfa, Clovers, Trefoil and Legumes

6" to early bloom

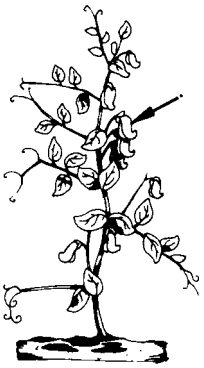
Sample top 6" or top one-half of plant if plant is less than 8" tall from 35 plants.



Soybeans, Snap Beans and Peas

Prior to or during initial flowering.

Sample first fully developed trlfoliate and petiole from the top of 25 plants



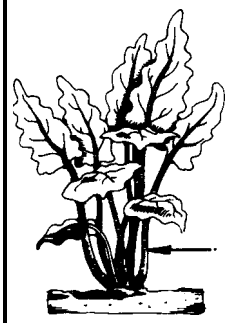
Small Grains & Grasses Seedling

Seedling

Sample entire above ground portion of 40 plants

Prior to head emergence

Sample top leaves down to 4th or 5th leaf from 50 plants



Beets, Radishes and Celery

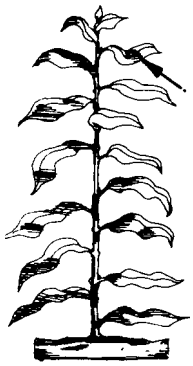
Anytime during growing season.

Sample petioles of recently fully expanded mature leaves from 20 plants.

Grain Sorghum or Sorghum-Sudan

Prior to head emergence

Sample 2nd fully developed leaf from the top of 20 plants.



Potatoes, Tomatoes or Peppers

Prior to & during early flowering

Sample petiole and leaf blades of the 4th leaf from the growing tip of 40 plants