A collaboration between:

Plant Tissue Sampling

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Background

- Plant analyses are useful to diagnose nutritional problems and to monitor the fertilization program. Tissue testing is most effective when used together with soil testing [13].
- Nutrient concentrations change as plants grow and also differ between plant parts [6]. It is therefore important to sample specific plant parts at a particular growth stage (Table 1). For information on optimal nutrient concentrations at different growth stages, see the fertilization guidelines for the different crops (http://apps.cdfa.ca.gov/frep/docs/Intro.html)
- Archiving the results from the analyses allows tracking changes in the same field over time [6]. Plant analyses together with soil analyses and nutrient budgets allow evaluating the fertilization program on the long term [4].

General Sampling Instructions

- When plant development differs within a field, the field should be divided into different management areas with similar characteristics and a sample from each area should be taken. To facilitate interpretation, fields are best divided into the same areas as is done for soil samples.
- Randomly select plants throughout the field or management area and sample the correct plant parts [4, 13]. For plant parts and number of plant parts to sample, see Table 1.
- Collect the specific plant parts and place them into a clean paper bag [13]. Do not use plastic bags to avoid decay of samples. Do not use metal containers, because they may contaminate the samples and affect micronutrient results [4, 14].
- Do not collect samples during the hottest part of the day, particularly in summer [14].
- Do not take samples from dead, diseased, insect damaged, or mechanically injured plants [6, 13]. Also avoid plants from unusual areas in the field, including border areas and places where plants are under water stress or where nutrient availability is atypical [6].
- Dust or soil covered plant parts should also be avoided, especially when the samples are used for micronutrient analysis [6].
- Small amounts of dust can be removed by gently brushing the samples with a soft brush [13]. Alternatively, the samples may be cleaned with a damp cloth, but should not be rinsed or washed to prevent leaching of nutrients from the sample [13, 14].
- Deliver the samples immediately to the lab or use a one-day delivery service [13, 14]. If immediate delivery is not possible, air-dry the samples in the shade by placing the open bag in a clean, dust-free area [3, 4, 14]. Mix the samples frequently to avoid decay.
- Clearly label the bag, and provide the information required by the test lab [4].
- Follow the laboratory instructions for packaging and shipping.

- To determine the cause of visual symptoms or a suspected deficiency in one part of the field, two samples may be taken; one from the plants of interest, the other from adjoining normal plants in the same field or management area [6].

Table 1: Sampling procedure for major field crops

Crop	Growth stage	Plant part to sample	Number of plants to sample
Field Crops			
Alfalfa	10% bloom	stems in the middle third of the plant	40-60 stems from at least 30 plants
Dry Beans	Early growth	Petiole of fourth leaf from the growing tip	40
	Pre-bloom	Petiole of fourth leaf from the growing tip	40
	Late bloom	Petiole of fourth leaf from the growing tip	40
Corn	Early season (6-16 inches)	Whole plant	20-30
	Midgrowth (3-6 feet)	First fully developed leaf; third leaf from top	15-25
	Tasseling	Leaf opposite and below primary ear	15-25
	Silking	Leaf opposite and below primary ear	15-25
Cotton	Early squaring to late season	Third to fifth petiole from the terminal on the main stem	30-40
Rice	Early stages	Most recently fully expanded leaf (Y-leaf)	50
	Later stages	Most recently fully expanded leaf (Y-leaf)	30-60
Safflower	Prebloom	Stem, middle section	40
	First bud visible	Recently matured mid-stem leaves	40
Sunflower	Just before floret emergence	Most recently matured leaf (3rd or 4th from the terminal bud	20-30
Processing Tomatoes	First bloom to 10% of fruits showing red color	Fourth leaf from the growing tip	40
Wheat and barley	3-4 leaf	Whole plant	50-100
	Tillering	Top 3-4 leaves	50-100
	Jointing	Top 3-4 leaves	50-100
	Booting	Top 3-4 leaves	50-100
	Early heading (hard red wheat N only)	Flag leaf	50-100

Sources: Alfalfa [9,12] , dry beans [2], corn [6], cotton [1,11], rice [10], safflower [2,7], sunflower [2,4,7], tomatoes [7,8], wheat and barley [6]

Table 2: Sampling procedure for major vegetable and berry crops

Crop	Growth stage	Plant part to sample	Number of plants to sample
Vegetables			
Broccoli	First buds to heading	Recently matured leaf, typically 3-4 nodes down from the growing point	20-60
Carrot	Midgrowth (>4 inches high)	Most recently matured leaf or petiole	20-30
Cauliflower	Head initiation	Recently matured leaf, typically 3-4 nodes down from the growing point	20
	Preharvest	Recently matured leaf, typically 3-4 nodes down from the growing point	20
Celery	Mid-growth	Most recently matured leaf or petiole	20
	Preharvest	Most recently matured leaf or petiole	20
Melon	Early flower	Most recently matured leaf or petiole, typically 6th from the growing tip	20-30
	Early fruit set/bulking	Most recently matured leaf or petiole, typically 6th from the growing tip	20-30
	First harvest	Most recently matured leaf or petiole, typically 6th from the growing tip	20-30
Onion	Early season	Tallest leaf	20-30
	Midseason	Tallest leaf	20-30
	Late season	Tallest leaf	20-30
Potato	Early season	Petiole of fourth leaf from the growing tip	40
	Midseason	Petiole of fourth leaf from the growing tip	40
	Late season	Petiole of fourth leaf from the growing tip	40
Lettuce	Early heading to pre-harvest	Youngest wrapper leaf	20-60
Berries			
Strawberry	Preharvest	Young mature leaves	30-40
	Main harvest	Young mature leaves	30-40

Sources: Broccoli, cauliflower, celery and lettuce [5, 6], carrot [2,6], melon [2,7], onion [8], potato [7,16], strawberry [15]

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