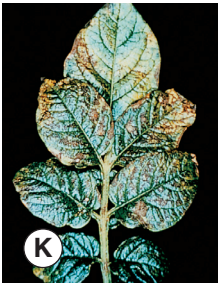
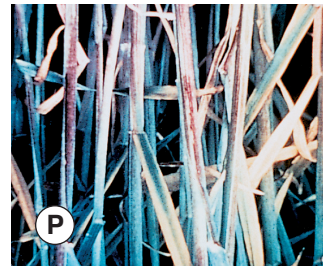
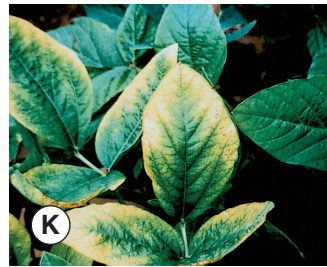


Plant Nutrient Analysis Sampling Guide



Reasons to do Plant Nutrient Analysis

Spoon Feeding Nutrients: For irrigated crops, plant analysis can be used as an aid in making decisions about nutrient applications such as nitrogen and some micronutrients. One example is petiole testing in irrigated potatoes. Nitrate nitrogen levels in the potato petiole are determined weekly, and the information is used to help make nitrogen fertilization decisions all season long. Plant analysis is also used in fruit and vegetable crops as a guide for nutrient application during the season.

Monitor and Fine Tune Fertility Plans: Plant analysis is a good way to confirm that your fertility management plan is working. Plant analysis can be used to evaluate new fertilizer placement and timing techniques. The information collected can then be used to make necessary adjustments to your fertility plans.

Confirm Visible Nutrient Symptoms: Nutrient deficiency symptoms should be confirmed with plant analysis. Using visible symptoms to identify which nutrient is deficient is very difficult. One example of this difficulty is distinguishing between nitrogen and sulfur deficiencies in a crop such as wheat. Plant analysis may confirm a suspected nutrient deficiency or it may indicate that another nutrient is the problem.

Detect “Hidden Hunger”: Plants can experience nutrient deficiencies without expressing any visual symptoms. These plants are said to be experiencing “hidden” hunger. While no symptoms are present, these minor nutrient deficiencies can still cause yield losses of 10-15%.

Types of Plant Analysis

Total Nutrient Analysis: This type of plant analysis includes all forms of each nutrient found in plant tissue. One example is the total nitrogen analysis of plant tissue. The analysis for total nitrogen includes the nitrate, ammonia, and organic forms of nitrogen in the plant. The total nutrient content of nitrogen, phosphorus, potassium, calcium, magnesium, sulfur and chloride are reported as a percent (%), due to their high concentrations in plant tissue. Nutrients such as zinc, copper, manganese and iron are present at much lower concentrations in plant tissue and are reported as parts-per million (ppm).

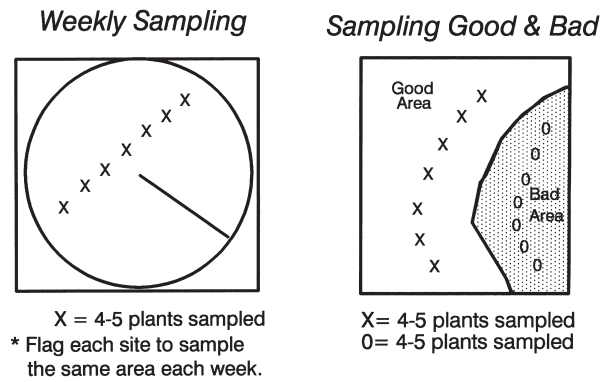
The total nutrient content of plant tissue is a reflection of the entire growing season until the time the plant sample is collected. The total nutrient content does not predict the nutrient status of the plant many weeks into the future.

Total nutrient analysis can be determined on various plant parts, including whole plants, whole leaves and petioles. It is important to collect the correct plant part based on the stage of growth the crop is currently in (see figures on pages 6 & 7). University research has determined the sufficiency range for each nutrient, for a specific plant part, at a specific stage of growth. If another plant part is collected for analysis, interpretation for adequate nutrient levels is difficult.

Petiole Nutrient Analysis: In some situations, nutrients are tested on a plant part called the leaf petiole. In irrigated potato production, the petiole is tested for the nitrate form of nitrogen. The nitrate level in the petiole provides information about the recent status of nitrogen uptake of the crop. For example, nitrogen taken up by potatoes can be detected in

the petiole nitrate analysis within 3-4 days after fertilizer application. Because the petiole nitrate test indicates the nitrogen status of the plant in the past 2-3 days, it is a very good tool for in season nitrogen decisions in irrigated potato production. Petioles can also be analyzed for total nutrient content through the season for crops such as potatoes. The petiole part of a potato plant leaf is shown in the potato sampling instructions (see page 6).

Figure 1



Sampling Strategies in the Field

Routine Sampling for Plant Analysis:

Weekly plant analysis is common in high value crops such as potatoes. It is very important to collect plant samples in the same area of the field each time. There are several sampling strategies that will represent the field similarly each week. One strategy is to place flags in 15 locations within a field. Each week, several plants are sampled near each flag location and combined to make a composite plant sample (see figure 1). A second approach is to choose a small area in each field to serve as benchmark for the entire field. It is critical to work with the grower in choosing an area that is an average of the field. This benchmark area also needs to be marked with flags so plant sample comes from the same area of the field each time (see figure).

Sampling Good and Bad areas in a field:

If you are investigating the differences between the **Good** and **Bad** areas of a field, a plant and soil sample from each area is recommended. A topsoil sample from each area of the field is very helpful (subsoil also if possible). The soil sample will indicate if the problem is related to the nutrient level in the soil or other factors such as compaction, high salinity, excessive sodium, soil pH, etc.

Specific Plant Part to Collect Based on Stage of Growth

The nutrient level in plant tissue depends on the plant part that is tested and the stage of plant growth. For most crops there are three time periods when plant nutrient analysis is conducted. The early vegetative stage, late vegetative stage and during the reproductive stage. For small grains like wheat and barley early in the season, the whole above ground plant is collected for nutrient analysis. During heading the flag leaf is the plant part to collect. It is important to collect the correct plant part because nutrient levels in other plant parts may be different. An example of how nutrient levels change with the plant part is shown in the table below.

Effect of Petiole Position on Nutrient Concentration

Petiole Position	NO ₃ -N Nitrate	P Phosphorus	K Potassium	Zn Zinc
	(ppm)	(%)	(%)	(%)
2	13000	.29	8.0	37
3	15100	.24	9.1	32
*4	15700	.22	9.7	25
5	18200	.20	9.7	23
6	19200	.19	9.9	19
7	19400	.17	10.0	19

* = petiole to collect for analysis.

Things Not to do When Collecting Plant Samples

1. Do not include plants that have been showing visible deficiency symptoms for more than 10 days. Nutrient analysis of plants that have experienced nutrient stress for an extended time may be misleading. Example: a plant is deficient in sulfur for two weeks before plant nutrient analysis is done. The analysis may indicate that sulfur and nitrogen are deficient. This is because a lack of sulfur has caused problems with the

nitrogen metabolism of the plant, not because nitrogen was deficient.

2. Do not include plants that are under stress due to disease. Root and foliar diseases can interrupt water/nutrient uptake or flow in the plant resulting in misleading information.

3. Do not include plants that are affected by excessively wet soil, herbicide drift, cultivator damage, etc. Any severe stress can cause a nutrient imbalance in the plant.

Plant Sample Care and Shipping

1. All excessive dust should be shaken or brushed off the plant sample. Excessive dust on the plant sample will result in high iron test levels due to the high iron content of the dust (do not wash dust from the plant sample because nutrients such as potassium will also be removed).


2. Use ventilated sample envelopes supplied by AGVISE for all plant samples. Two different sizes of plant sample envelopes are available from the lab at no charge. Ventilated sample bags prevent the plant sample from deteriorating in shipment. Samples which have become moldy in shipment cannot be used for nutrient analysis.

3. If samples cannot be shipped immediately, place them in a refrigerator to avoid sample deterioration from occurring.

4. Please call and speak with one of our professional technical support staff if you have any questions on how to collect plant samples or ship samples to the laboratory. We can instruct you in the collection of a representative plant sample but we can't provide good information from a poor quality sample or a sample that has deteriorated in shipping.

Sample Information on Plant Sample Envelope

Complete the information requested on the ventilated plant sample envelopes provided by AGVISE Laboratories (for irrigated potatoes see next page). The following information must be completed on the sample envelope: sample ID, crop, plant part submitted, stage of growth, and the test option you need (see example). It is very important that the information be filled in completely so we can provide you with fast service and the best interpretation of your plant analysis.

		Date Sampled ____/____/____ Date Received ____/____/____
GROWER NAME <u>Mr. Grower</u>		FIRM SUBMITTING SAMPLES NAME <u>Top Yield Company</u>
ADDRESS <u>Green Fields</u> Top City _____ ZIP <u>54321</u>		ADDRESS <u>Wide Avenue</u> Top City _____ ZIP <u>54321</u>
Crop <u>Pinto Beans</u> variety <u>Othello</u>	County <u>GF</u> Field I.D. <u>East 80</u>	
Irrigated <input type="checkbox"/> Dryland <input checked="" type="checkbox"/>	Range _____ Township <u>Wiley</u> Acres <u>80</u>	
Growth Stage <u>Vegetative</u>	Section <u>22</u>	
CHECK PLANT PART SAMPLED: Leaves <input checked="" type="checkbox"/> Petiole _____ Whole Plant _____	Quarter <u>SW</u>	
Normal <input checked="" type="checkbox"/> Abnormal _____		
OPTION CHOICES (Check the Desired Option)		
Complete Analysis: Total Nitrogen, Phosphorus, Potassium, Calcium, Magnesium, Sodium, Zinc, Iron, Manganese, Copper, Boron, Chloride (Chloride included on small grain) _____		<input checked="" type="checkbox"/>
Potato Petiole Option: Nitrate-Nitrogen, Phosphate-Phosphorus _____		
Individual Nutrients: Total Nitrogen _____		
Nitrate-Nitrogen _____		
Phosphate-Phosphorus _____		
Chloride _____		
Boron _____		
Other Tests: _____		

Sample Information Form for Irrigated Potatoes

AGVISE has developed a sample information form for petiole samples from irrigated potato fields. This form will save you a lot of time when fields are sampled weekly to assess plant nutrient levels. The first time you collect a petiole sample or soil sample from a potato field, you need to fill out the form completely as shown. The appropriate sticker from the form should be placed on the petiole bag and soil bag as shown. *You must send the pink copy of the completed form with the first petiole sample submitted.* This is so the laboratory gets the important information about the field and the analysis you need. You will keep the white and yellow copy of the form through the growing season. Each time you collect another plant sample from the same field, you just take the next reference number sticker from the form and place it on the sample bag.

You never have to write on the sample bag, just put the next reference number sticker on the bag.

The number on the sticker tells us which field the sample came from and what to test on the sample. We received that information on the pink copy of the information sheet sent in with the first sample.

604 Highway 15 West, P.O. Box 510
Northwood, ND 58267
701-587-6010
FAX 701-587-6013
agvise@polarcomm.com

902 13th Street North, Box 187
Benson, MN 56215
320-843-4109
FAX 320-843-2074
agvise@willmarnet.com

**Potato Nutrient Monitoring
Sample Information Sheet**

CRITICAL INFORMATION FOR INTERNET GRAPHING

Field ID: West Pivot Field Number: 29
 Potato Variety: Russet Burbank Emergence Date: 6-1-11

PINK COPY MUST BE SENT WITH FIRST SAMPLE

Dealer Name: Mr. Dealer
 Address: 123 East Street
 City: Green City Zip: 54321
 Account #: MR2952 Phone: 701-555-1234
 County: Wells Section: 21
 Township: Kinney Acres: 140

Ref #
32732

Petiole Analysis (Check one only)
 Complete Analysis
 Nitrate Only
 Nitrate & Phosphate
 Phosphate Only

Soil Analysis (Check one only)
 Nitrate & Ammonium
 Nitrate Only

Petiole Analysis (Petiole Only)

STEP 1
Remove the entire 4th leaf including petiole and leaflets from 30 plants.

STEP 2
Remove leaflets from the petiole.

STEP 3
Place the petioles only from the 4th leaf of 30 plants in the petiole sample bag.

Place Barcode Sticker on Petiole sample bag where indicated

WEEK 1: Petiole Sample

Field ID West Pivot Date: 6-15-11
 Tuber Stage: (Check one) JTL Sampler: JTL
 Tubers <3/4" Ref # P12345
 Tubers 3/4" - 2"
 Tubers >2"
 Tubers >3.5"

WEEK 6: Petiole Sample

Field ID _____ Date: _____
 Tuber Stage: (Check one) Sampler: _____
 Tubers <3/4" _____ Ref # P12345
 Tubers 3/4" - 2" _____
 Tubers >2" _____
 Tubers >3.5" _____

A tuber size must be checked for each sample

Soil Sample Number 1

Field ID _____
 Sample Depth 0 - _____ inches (i.e. 0-18")
Soil Analysis Requested (check one only)
 Nitrate & Ammonium Ref # P12345
 Nitrate Only

Soil Sample Number 2

Field ID _____
 Sample Depth 0 - _____ inches (i.e. 0-18")
 (check one only)

AGVISE LABORATORIES

Completely fill out sample information on field info sheet. IDENTIFY YOUR SAMPLE

Soil Sample Number 1

Field ID West Pivot
 Sample Depth 0 - 18 inches (i.e. 0-18")
Soil Analysis Requested (check one only)
 Nitrate & Ammonium Ref # P12345
 Nitrate Only

Name _____
 Sample ID _____
 Sample Depth: 0 to 6 6 to 24
 Other _____ to _____

WEEK 1: Petiole Sample

Field ID West Pivot Date: 6-15-11
 Tuber Stage: (Check one) JTL Sampler: JTL
 Tubers <3/4" Ref # P12345
 Tubers 3/4" - 2"
 Tubers >2"
 Tubers >3.5"

AGVISE LABORATORIES

FIRM SUBMITTING SAMPLES

GROWER NAME _____ ADDRESS _____ ZIP _____
 DATE SAMPLED _____ DATE RECEIVED _____

Crop _____ Variety _____ County/Range _____ Field ID _____
 Irrigated Dryland Township _____ Acres _____
 Growth Stage _____ Section _____
 CHECK PLANT PART SAMPLED: Quarter _____
 Leaves _____ Petiole _____
 Normal _____ Abnormal _____

Petiole Analysis (Petiole Only)

(Check one only)
 Complete Nutrient Analysis _____
 Nitrate & Phosphate _____
 Nitrate Only _____
 Phosphate Only _____
 Other _____

All Growth Stages: Remove leaflets from the petiole and submit only the petiole from the 4th leaf of 30 plants.

Place Petioles "ONLY" in petiole sample bag

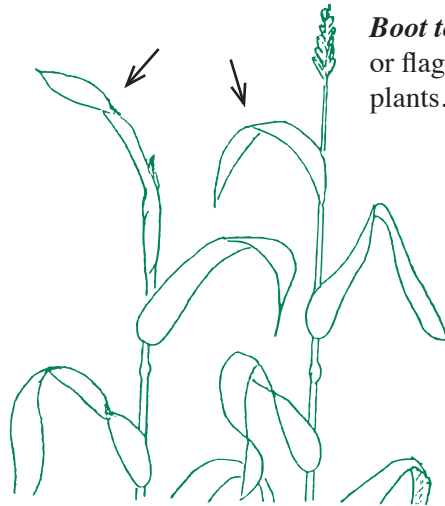
You don't have to fill in any of the information on the petiole bag or the soil sample bag as long as the reference number sticker is placed on each bag. Call AGVISE if you have any questions.

Sampling Guide for Plant Analysis

GRAIN AND GRASS



Seedling to tillering: Cut plant off about 1/2 inch above ground. Sample 50 plants.



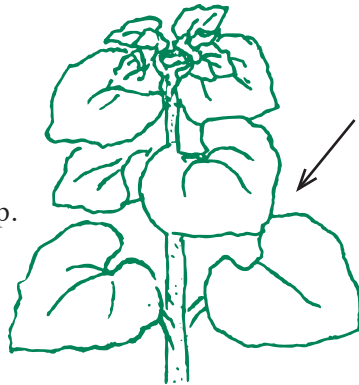
Boot to heading: Top leaf or flag leaf. Sample 50 plants.

SUNFLOWER



4-8 leaves: Cut plant off 2 inches above ground. Sample 25 plants.

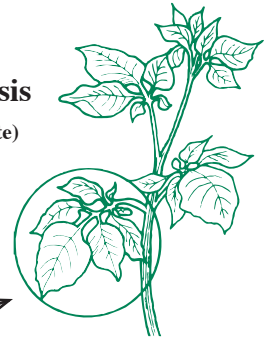
Bud to Bloom: 3rd mature leaf from top. Sample 20 plants.



POTATO

Complete Nutrient Analysis
(Excluding petiole Nitrate & Phosphate)

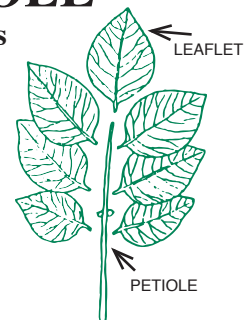
All growth stages:
Submit entire 4th leaf including petiole and leaflets from 20 plants



POTATO PETIOLE

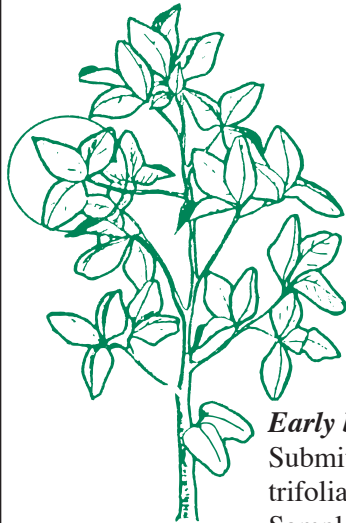
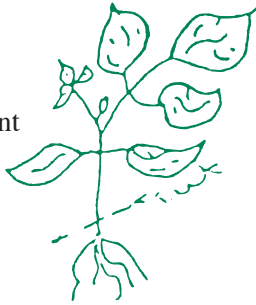
Complete Nutrient Analysis
or Nitrate and Phosphate Analysis

All growth stages:
Remove leaflets from the petiole and submit only the petiole from the 4th leaf of 30 plants.



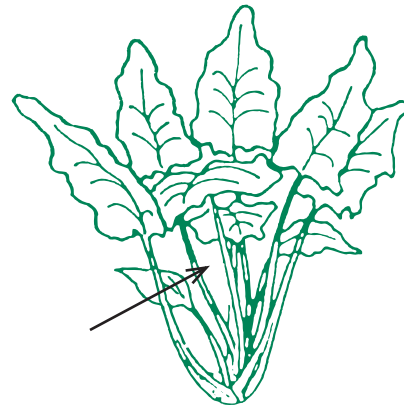
SOYBEANS DRY BEANS

1st to 3rd trifoliolate: Cut plant 1 inch above surface and submit entire plant. Sample 25 plants.



Early bloom to podset: Submit first fully developed trifoliolate leaf from top. Sample 25 plants.

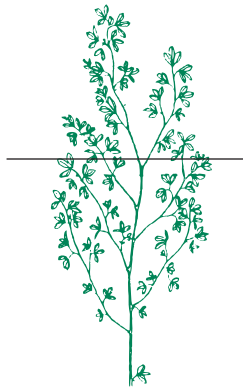
SUGARBEETS



All growth stages: Submit 25 petioles for nitrate analysis. Submit 25 leaf blades of a fully expanded, recently mature leaf for complete nutrient analysis.

ALFALFA

All growth stages: Submit top 6 inches or top half of plant if less than 8 inches tall. Sample 20-25 plants.



CANOLA

Seedling to rosette stage: Collect entire above ground plant. Sample 20 plants.

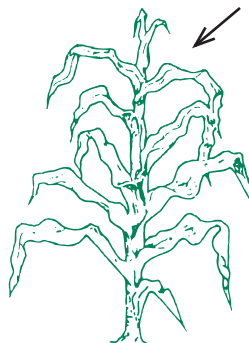


Rosette to pod development stage: Collect 5th leaf from top without petiole, from 30 different plants.

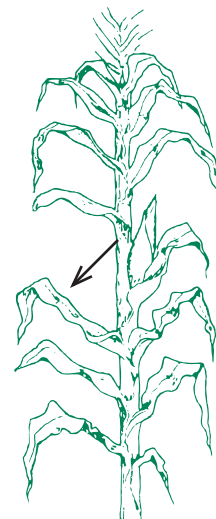
CORN



0-12 inches tall: Cut stalk off about 1/2 inch above ground level. Submit 20-25 whole plants.



> 12 inches but prior to tasseling: Submit first fully developed leaf from top (first leaf below whorl). Cut leaf at its base where it joins sheath. Sample 20-25 plants.



Tasseling to pollination: Submit leaf below and opposite ear. Cut leaf at its base where it joins sheath. Sample 20-25 plants.



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