Plant Tissue Sampling Guide

Plant Tissue Analysis

Plant tissues analysis is an extremely useful tool that can be used to monitor the nutrient status of plants and can help identify nutrient deficiencies and imbalances. Plant tissue testing is particularly useful for determining the timing of nutrient applications, ensuring the right balance of different nutrients, and for confirming possible trace-element deficiencies before they affect production. This allows growers to more effectively tailor their nutrient management programs to meet a crop's specific needs. Cost savings may be realized if nutrient deficiencies are resolved before they adversely affect production and also if unnecessary fertilizer applications are avoided.

Plant Analysis vs. Soil Testing

Soil testing and plant tissue analysis are similar in that they both measure nutrients necessary for plant growth. Soil tests are most useful prior to planting to predict nutrient needs in the soil; tissue tests are best used during the growing season to monitor plant nutrient uptake. When growth problems occur, both tests are necessary to provide a complete diagnosis of a crop's nutritional status and best corrective action. Many factors affect the ability of plants to take up nutrients. Tissue testing is the best way to find out the nutritional composition of plants.

"Providing value to our customers through on-time quality testing with friendly service"

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Photo courtesy of USDA NRCS

In What Circumstances Would Plant Tissue Analysis Be Suggested?

1. Routine Assessment – Leaf and/or petiole samples are collected at the appropriate time of year and sent in to monitor nutrient levels in plants.
2. Trouble Shooting – If observing leaf symptoms that may indicate a nutritional problem, samples are sent in from plants showing symptoms and also those without for a comparison.

Sufficiency Ranges for Plant Analysis

Plant analysis reports sufficiency ranges. The sufficiency range is based on the relationship between nutrient concentration and yield. Results are sensitive to plant maturity and plant part sampled. Interpretations are reliable only when used for the specific plant part sampled at the specific growth stages where interpretations have been developed.

Sufficiency Ranges for Plant Analysis

Crop	%Nitrogen	%Phosphorus	%Potassium	%Calcium	%Magnesium	%Sulfur
Corn(Early)	3.5 - 5.0	0.4 - 0.8	3.0 - 5.0	0.9 - 1.6	0.3 - 0.8	0.2 - 0.3
Corn(Silk)	2.76 - 3.75	0.25 - 0.50	1.75 - 2.75	0.30 - 0.60	0.16 - 0.40	0.16 - 0.50
Soybeans	4.01 - 5.50	0.31 - 0.50	1.51 - 3.00	0.35 - 2.00	0.30 - 1.50	0.21 - 0.40
Oats/Barley	1.3 - 3.0	0.2 - 0.4	1.0 - 3.0	0.2 - 0.5	0.1 - 0.4	0.1 - 0.4
Wheat	2.7 - 3.5	0.2 - 0.4	1.5 - 3.0	0.2 - 1.0	0.2 - 0.5	0.1 - 0.4
Alfalfa	2.51 - 3.70	0.26 - 0.70	2.41 - 3.80	0.50 - 3.00	0.31 - 1.00	0.31 - 0.50
Grasses	1.8 - 3.0	0.3 - 0.5	2.0 - 3.0	0.3 - 0.6	0.2 - 0.4	0.2 - 0.4
Sugarbeets	3.0 - 4.5	0.25 - 0.5	2.0 - 3.0	0.35 - 0.7	0.3 - 0.7	0.21 - 0.5
Potatoes(1)	3.5 - 4.5	0.25 - 0.5	4.0 - 6.0	0.5 – 0.9	0.25 – 0.5	0.3 - 0.45
Potatoes(2	Tuber Initiation 1.7 - 2.2	0.22 – 0.4	8.0 – 10.0	0.60 – 1.0	0.3 -0.55	0.2 – 0.35
	Tuber Bulking 1.1 1.5					
	Maturation 0.6 - 0.9					

Crop	Manganese ppm	Iron ppm	Zinc ppm	Copper ppm	Boron ppm
Corn(Early)	50 - 160	50 - 300	20 - 50	7.0 - 20	7.0 - 25
Corn(Silk)	19 - 75	50 - 250	19 - 75	3.0 - 15.0	5.1 - 40.0
Soybeans	21 - 100	51 - 350	21 - 50	6.0 - 20.0	20.0 - 50.0
Small Grain	25 - 150	25 - 200	12 - 40	5 - 20	5 - 15
Wheat	25 - 150	25 - 200	20 - 60	5 - 25	4 - 30
Alfalfa	21 - 200	30 - 250	20 - 70	3.0 - 30.0	30.1 - 80
Grasses	30 - 150	50 - 200	20 - 50	7 - 15	5 - 15
Sugarbeets	21 - 120	50 - 200	19 - 50	11 - 30	25 - 35
Potatoes(1)	20 - 450	30 - 150	20 - 40	5 - 20	20 - 40
Potatoes(2)	30 - 300	50 - 200	20 - 40	4 - 20	20 - 60

(1) Potatoes
Whole leaf potato tissue (leaflets plus petioles from the 4th leaf from the top of the shoot during the tuber bulking stage

(2) Potatoes
Whole leaf potato tissue (petioles from the 4th leaf from the top of the shoot during the tuber bulking stage

Collecting (Leaf) Samples

Reliable tissue test results depend on collecting indicator samples and adhering to consistent sampling procedure.

- The best time to take samples is between mid-morning and mid-afternoon, avoiding rain events.
- Roots or foreign material attached to the sample should be removed and discarded. Dust off plant tissue to remove soil particles. DO NOT WASH tissue since soluble nutrients will be leached out of sample.
- Do not sample disease or insect damaged plants.
- Use vented envelopes, clean paper, or cloth bag for sample collection.
- Do not mail samples in plastic bags or when samples are wet.
- Avoid shipping late in the week in order to preserve integrity of fresh samples.
- Samples delivered at a later date to the lab may be kept frozen or air-dried until they are delivered.

Plant Sampling Chart for Field Crops

Field Crops	Stage of Growth	Plant Part To Sample	# of Plants to Sample
Alfalfa	At 1/10 bloom stage or before.	Mature leaf blades about 1/3 of the way down the plant – about top 6" of plant.	15-25
Small Grains	Seedling stage	All the above ground portion.	30-50
	Prior to heading	Primarily the flag-leaf, but may include 1st 4 leaf blades about 1/3 of the way down.	20-30
Clover	Prior to bloom	Mature leaf blades about 1/3 of the way down the plant.	15-25
Corn	Seedling stage	Whole plant <12" height.	15
	Prior to tasselling	The last fully developed leaf near whorl – this will be the newest leaf to have an arc shape.	10-15
	Tasselling to silking	The leaf located opposite and below the ear.	10-15
Hay, Forage, or Pasture Grasses	Before seed head emergence or at the stage for best quality.	Typically the top 6" of the plant. Some prefer the 4 most upper leaf blades.	50-60
Potatoes	In-season	Whole leaf + petioles from the 4th leaf from top of the shoot during tuber bulking stage.	30-40
	In-season	Petioles from the 4th leaf from the top of the shoot during tuber bulking stage.	40-55
Sourgham	Prior to head emergence	Second fully emerged mature leaf from the top	15-20
Soybeans	Seedling stage	All of the above ground portion.	15-30
	Prior to or during initial flowering	Fully developed leaves at the top of the plant.	20-30
Sugarbeets	Mid-season	Fully mature leaves midway between the younger center leaves and the oldest leaf whorl on the outside.	30-35
Sunflowers	Early flowering	Top fully developed leaf.	25-30

Basal Stalk Sampling for Corn

Basal stalk test is a diagnostic – not a predictive test. It was not intended to predict the amount of fertilizer N needed for the next time that corn is in the rotation. However, its use does allow for a closer evaluation of the rates of fertilizer N used in a year that the corn was grown.

For best results, the sample should be collected after formation of black layer in the kernel. Waiting until after harvest to collect the sample could easily lead to inaccurate results.

In this analytical test an 8 inch section of the corn stalk starting at 6 inches above the soil surface is analyzed for parts per million of NO3-N. This section of stalk should include the bottom node of the plant. Only stalk, not leaf or sheath tissue, is submitted for the sample. Any other tissue should be removed before the sample is submitted. A representative sample should include at least 15 stalks from the area of interest.

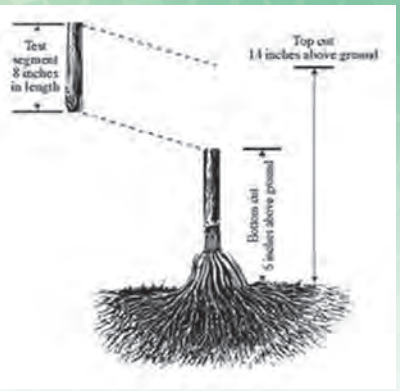
The results are compared to standards developed from field research. Advisors have worked with farmers to compare the impact of various rates of nitrogen fertilizer across the landscape. For these comparisons, this test, in addition to yield, would be an added feature in the evaluation of nitrogen rates. This test could also be used in the evaluation of management zones.

Collecting Basal Stalk Sample

- Cut, BEGINNING at the 6-inch mark above the ground. Collect 8" section of stalk including the first node.
- Remove any leaves and leaf sheaths from the segment.
- Do not sample diseased stalks, unusually stunted plants, stalks damaged by hail or insects (e.g., European corn borer), or stalks with no ear or extremely small ears.
- Keep the stalk segments as cool and clean as possible while you finish collecting the other samples.
- Place each group of 15 stalk segments into a paper (NOT plastic) bag for shipment to the testing laboratory.
- Paper bags minimize mold growth during shipment and facilitate additional drying.
- Samples should be refrigerated (NOT frozen) if stored for more than a day before mailing to the lab.
- Ship fresh stalk samples to a laboratory for nitrate analyses early in the week to insure sample integrity.
- If drying samples prior to shipment--- split the stalk vertically parallel to the length of the corn stalk. Splitting each stalk into four sections is ideal. Use of an oven or placing in front of a fan blowing warm air is suggested for rapid drying.

When interpreting the basal stalk nitrate values, it's important to remember that factors other than excessive use of N fertilizer can lead to high values. Anything that can cause a severe reduction in yield such as hail damage or drought can lead to high values.

NO3-N	Interpretation
0 to 250 ppm -	low, nitrogen was probably deficient during the growing season
250 to 700 ppm -	marginal, it is possible that nitrogen shortage limited yield
700 to 2,000 ppm-	optimum, yield was not limited by a shortage of nitrogen
2,000+ ppm -	excessive, nitrogen rate was too high or some production factor caused a yield reduction



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	Option 1	Individual Analysis
	List Nutrient:	
	Option 2	Basic Includes N, P, K
	Option 3	Complete Analysis *(Includes N,P,K,Ca,Mg,S,Mn,Fe,Zn,Cu,B)*
	Option 4	Cornstalk Nitrate Test

Submitted By	Name:		
Address:			
City:		State:	Zip:
Email:			

Submitted for Producer	Name:		
Address:			
City:		State:	Zip:

Plant Information *	Date Sampled:	
Plant Type:	Plant Stage:	Portion of Plant:

Field Information	

Field ID: #1	Sample ID: #1
Field ID #2:	Sample ID #2:
Field ID #3:	Sample ID #3:
Field ID #4:	Sample ID #4:
Field ID #5:	Sample ID #5:
Field ID #6:	Sample ID #6:
Field ID #7:	Sample ID #7:

*Please provide all plant information