Virginia Cooperative Extension
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Part VIII.

Soil Testing and Plant Analysis

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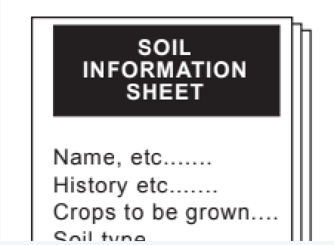
Soil testing and plant analysis are important agronomic tools for determining crop nutrient needs. Soil testing evaluates the fertility of the soil to determine the basic amounts of fertilizer and lime to apply. Plant analysis, on the other hand, is used as a monitoring tool to determine if the fertilization and liming program, as determined by the soil test, is providing the nutrients at the necessary levels for top yields. Plant analysis is the ultimate test (i.e., is the plant obtaining ample nutrients for good growth and development from the soil?). If not, nutrients can be added during the existing growing season to improve yields, or the fertilization program can be modified for next year's crop. The following sections discuss how to use soil testing and plant analysis to evaluate crop nutrient needs.

Soil Testing

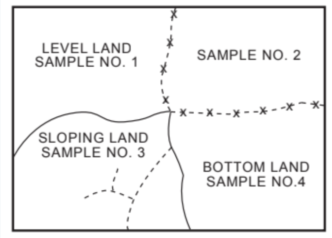
Sampling Instructions

Collecting the sample is one of the most important steps in the soil testing program. When one considers that a 2-pound soil sample must adequately represent 10 million or more pounds of soil in the area being sampled, the importance of doing a good job of sampling becomes apparent. Here are instructions for collecting a good representative soil sample.

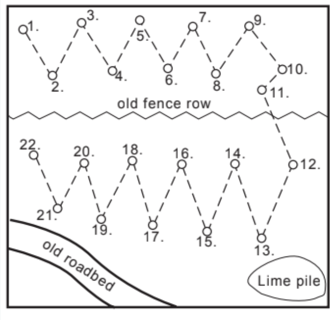
Sampling Soil



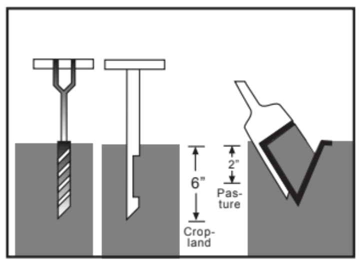
1. **Get Soil Sample Information Sheets and soil boxes.**
   These can be obtained from your local Extension office or from the Virginia Tech Soil Testing Lab. Follow the directions they provide.



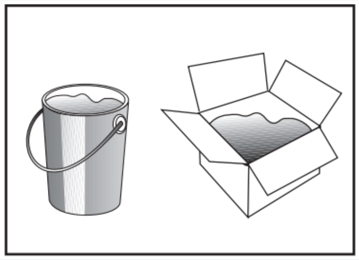
2. **Divide farm into areas or fields.**
   If the field is uniform, one composite sample will do. But most fields will have been treated differently, or the slope, drainage, or soil type will make it desirable to divide the field into small areas of 5-10 acres each.



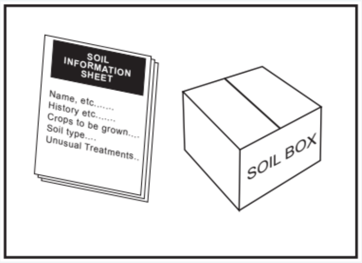
3. **Obtain a good sample of soil.**
   The soil test can be no better than the sample. Take the sample from 20 or more places in the field. Zigzag across the field or area as shown in the diagram. When taking the sample, avoid unusual places such as old fencerows, old roadbeds, eroded spots, where lime or manure have been piled, or in the fertilizer band of row crops.



4. **Use proper sampling tools.**
   Sampling can be made with a soil auger, soil tube, or spade. The desired depth for cropland is plow depth (6-8 inches or more), and 2-4 inches for pastureland, or no-till crop fields. Place sample in clean container.



5. **Mix well in a clean plastic pail.**
   From the 20 or more stops you have made, you now have 1 gallon or more of soil. Mix it thoroughly, then send about 1/2 pint of the mixed soil to the lab for analysis.



6. **Fill out a Soil Sample Information Sheet for each sample.**
   It is essential that your name, address, and sample number be clearly written on the sheet you send with each sample. As a guide in making recommendations for each of your numbered areas, it is important that the history of fertilization, liming, and any unusual treatments is stated.

7. **Mail to Soil Testing Laboratory.**
   Place the Soil Sample Information Sheet inside the top flap of the soil box and mail to the Virginia Tech Soil Testing Laboratory, 145 Smyth Hall (MC 0465), 185 Ag Quad Lane, Blacksburg, VA 24061

Soil Sampling for Precision Farming

Precision farming, also known as site-specific management, typically employs intensive soil sampling to map fertility in a field. Fertilizer and lime can then be applied at variable rates, according to the needs of the particular areas in the field. To begin, fields are first divided into grids, with typical grid size being 2.5 acres. For small fields, a 1-acre grid size will give a more precise representation of the fertility across the field, but for larger fields, this is usually not economically feasible.

The grid is established using a GPS. A radio receiver, connected to a portable computer and mounted on an ATV, is used to receive satellite coordinate signals to map the field and locate the grid points. Soil samples are then collected at each grid point, with six to eight subsamples being taken in a 10-foot circle around the ATV and mixed together for a composite sample. After lab analysis, soil test information from the field can then be fed into a computer mounted in a variable-rate fertilizer/lime spreader with GPS receiver, and material can be applied according to the needs of the various areas in the field.

“Smart sampling” techniques can also be employed to sample a field. This can be done in lieu of the above standard (uniform) grid sampling or as a follow-up to an initial grid sampling of the entire field. Smart sampling consists of sampling those areas of the field that are obviously different, such as with respect to topography (hilltops, low areas), or – if a combine yield monitor has been used – high-yielding and low-yielding areas in the field. If yield data are not available, one oftentimes has a good idea of the high-yielding and low-yielding areas in their field. These should be sampled separately. If the field has been mapped, it can be divided by soil series (i.e., soil mapping unit). Grid points should be located or grouped in those areas with unique visible or measurable differences.

Using the Soil Test Report - The Soil Test Report will contain the laboratory test results plus fertilizer and lime recommendations. Additional information regarding time and method of fertilizer and lime application will also be provided in the form of a Soil Test Note or Notes that will accompany the report. When several samples have been collected from the same field, the soil test reports should be compared to determine the best rates of fertilizer and lime to use for the field. Large differences in the reports could call for fertilizer and/or lime at two or more different rates. Advice on how to best fertilize a given field can be obtained from your local Extension agent or fertilizer dealer.

Plant Analysis

Sampling Instructions

1. Avoid submitting sample tissue that is contaminated with dust or soil. If tissue is dusty or dirty, remove as much of it as you can by shaking, brushing, or washing the tissue in gently flowing water.
2. Do not sample disease-, insect-, or mechanically damaged plant tissue.
3. Place the plant tissue in a clean paper bag. **Do not use plastic bags.** If the sample is wet or succulent, let it air-dry in the open for one day before sending it to the laboratory. Identify each sample by number and crop name.
4. When using tissue analysis in the diagnosis of crop productions problems, take one sample from the problem area in the field and one from an area where plants appear normal.
5. When sampling, both the time (growth stage) and plant part collected are important. Be sure to sample at the recommended time and collect the proper plant part.
6. If you do not have specific sampling instructions for the crop you wish to have analyzed, a good rule of thumb is to sample mature leaves that are representative of the current season's growth during the midperiod of the growth cycle or just prior to seed set.
7. Submit samples to recommended labs for testing. **Virginia Tech does not run tissue analysis.**

Interpreting the Laboratory Results

The Plant Analysis Report will contain the tissue test results plus the optimum nutrient ranges for the crop sample. Note whether levels are deficient, borderline, or adequate for good crop growth. Also make comparisons in soil nutrient levels between problem versus normal areas, noting any differences and whether they are small or large. Depending on what nutrient or nutrients are deficient and the stage of growth of the crop, it may or may not be worthwhile making additional fertilizer applications for the present crop. If trace element deficiency is noted and it is early enough in the growing season, a foliar application of the trace element can be applied to correct the problem. Following harvest, a more lasting soil application can be made for the next crop in the rotation.

If low magnesium and phosphorus plant tissue levels are observed, and the corresponding Soil Test Report indicates that the pH is low, it may not be possible to correct the problem for the present crop. Lime needs to be in the root zone to correct the problem, and this can be a difficult thing to do if it is not possible to till the lime into the soil. However, remedial action can and should be taken to ensure that the problem does not arise in future crops. The actual treatment needed will depend on the nature and severity of the problem and the economics involved. In most cases, it is usually worth the cost and effort to correct the problem.

Table 1. Sampling instructions for field crops.

Crop	Time	Plant Part to Sample	No. of Plants to Sample
Alfalfa	Early bloom	Top 4-6" of plant	30
Bermudagrass	Optimum time for maximum quality hay	Upper half of plant	50
Corn	Prior to 4th leaf stage	Whole plant, cutting at ground level	30
	Prior to tasseling	Entire leaf immediately below whorl, removing at stalk	20
	At silk when silks are still green	Entire ear leaf, removing at stalk	20
Cotton	At full bloom	Youngest recently mature leaves on main stem, collecting 2 leaves per plant	25
Peanut	At bloom stage	Last fully mature leaves at top of the plant, collecting 3 leaves per plant	25
Small Grains	Prior to jointing	Whole plant above ground, remove dead leaves	50
	Jointing to heading	Uppermost fully developed leaf	50
Soybeans	Prior to or at initial bloom	Uppermost fully developed trifoliate leaf set (composed of 3 leaflets) per plant. Remove leaf stem (petiole)	25
Tobacco	Prior to or at bloom	Entire 4th leaf from the top of the plant	15

Table 2. Sampling instructions for fruits, nuts, vegetables, and turf.

Crop	Time	Plant Part to Sample	No. of Plants to Sample
Fruit, nut			
Apple	8 to 10 weeks after full bloom	Leaves from spurs or near base of current season's growth, taking 4 to 8 leaves per tree	25 trees
Blueberry	Mid-summer	Mature leaves from mid-portion of current season's growth, taking 4 to 8 leaves per bush	25 bushes
Cherry	Mid-summer	Mature leaves near base of current season's terminal growth, taking 4 to 8 leaves per tree	25 trees
Grape	4 to 8 weeks after peak bloom	Petioles only (discard leaves) from mature leaves or nodes just beyond fruiting clusters	50 petioles
Peach	12 to 14 weeks after bloom	Mature leaves from mid-portion or near base of current season's terminal growth, taking 4 to 8 leaves per tree	25 trees
Pear	Mid-summer	Mature leaves from spurs, taking 4 to 8 leaves per tree	25 trees
Pecan	July 7 to August 7	Middle pair of leaflets from middle leaf of terminals around periphery of tree	25 trees
Vegetable			
Asparagus	Midgrowth	Mature fern from 18-36" up	10
Beet	Midgrowth	Young mature leaf, 3 leaves/plant	25
Broccoli	Heading	Young mature leaf, 2 leaves/plant	
Brussels sprout	Midgrowth	Young mature leaf, 3 leaves/plant	25
Cabbage	Head half grown	Young wrapper leaf, 2 leaves/plant	30
Cantaloupe	Prior to or at initial fruit set	Mature leaf near growing tip, 3 leaves/plant	25
Cauliflower	Buttoning	Mature leaf with stem removed	30
Collards	Midgrowth	Young mature leaf, 3 leaves/plant	25
Cucumber	Prior to or at initial fruit set	Mature leaf near growing tip, 3 leaves/plant	25
Green beans	Prior to or at early bloom	Uppermost mature leaves, 3 leaves/plant	20
Kale	Midgrowth	Young mature leaf, 3 leaves/plant	30
Onion	Midgrowth	Young mature leaf, 2 leaves/plant	30
Peas	Bud to full bloom	Entire top growth	15

Table 2. Sampling instructions for fruits, nuts, vegetables, and turf. (cont.)			
Crop	**Time**	**Plant Part to Sample**	**No. of Plants to Sample**
Peppers, bell	Midgrowth	Young mature leaf, 3 leaves/plant	30
Potatoes, Irish	Tubers half grown	Young mature leaf, 3 leaves/plant	25
Spinach	Midgrowth	Young mature leaf, 2 leaves/plant	25
Sweet corn	At silking when silks are green	Entire ear leaf, removing at stalk	20
Sweet potato	Midgrowth	4th leaf from a primary vine, counting down from growing tip	30
Tomato,	Early fruiting	3rd and 4th leaf from growing tip mech. harvest	50
Turnip greens	Midseason	Young mature leaf, 3 leaves/plant	25
Watermelon	Prior to or at initial fruit set	Mature leaf near growing tip, 3 leaves/plant	25
Turf			
Kentucky bluegrass	Normal growing season mowing	Clippings 7 to 14 days after last	1 pint

Table 3. Nutrient removal by crops.											
Crop	**Plant Part**	**Acre yield**	**N**	**P as P_2O_5**	**K as K_2O**	**Ca**	**Mg**	**S**	**Cu**	**Mn**	**Zn**
Row Crops											
Barley	grain	80 bu	70	30	20	2	4	6	0.06	0.06	0.12
Barley	straw	2 ton	30	10	60	16	4	8	0.02	0.64	0.10
	Total		**100**	**40**	**80**	**18**	**8**	**14**	**0.08**	**0.70**	**0.22**
Corn	grain	150 bu	135	53	40	2	8	10	0.06	0.09	0.15
Corn	stover	4.5 tons	100	37	145	26	20	14	0.05	1.50	0.30
	Total		**235**	**90**	**185**	**28**	**28**	**24**	**0.11**	**1.59**	**0.45**
Cotton	seed & lint	1500 lbs	40	20	15	2	4	3	0.06	0.11	0.32
Cotton	stalks, leaves	2000 lbs	35	10	35	28	8	15	-	-	-
	Total		**75**	**30**	**50**	**30**	**12**	**18**	**-**	**-**	**-**
Oats	grain	80 bu	50	20	15	2	3	5	0.03	0.12	0.05
Oats	straw	2 tons	25	15	80	8	8	9	0.03	-	0.29
	Total		**75**	**35**	**95**	**10**	**11**	**14**	**0.06**	**-**	**0.34**

Table 3. Nutrient removal by crops. (cont.)												
Crop	Plant Part	Acre yield	N	P as P_2O_5	K as K_2O	Ca	Mg	S	Cu	Mn	Zn
Peanuts	nuts	1.25 tons	90	10	15	1	3	6	0.02	0.01	–
Peanuts	vines	4500 lbs	105	25	95	–	–	–	–	–	–
	Total		**195**	**35**	**110**	**-**	**-**	**-**	**-**	**-**	**-**
Sorghum	grain	60 bu	50	25	15	4	5	5	0.01	0.04	0.04
Sorghum	stover	3 tons	65	20	95	29	18	–	–	–	–
	Total		**115**	**45**	**110**	**33**	**23**	**-**	**-**	**-**	**-**
Soybeans	grain	40 bu	150	35	57	7	7	4	0.04	0.05	0.04
Soybeans	straw		30	10	25	–	–	–	–	–	–
	Total		**180**	**45**	**80**	**-**	**-**	**-**	**-**	**-**	**-**
Tobacco	leaves	2000 lbs	75	15	120	75	18	14	0.03	0.55	0.07
Tobacco	stalks		35	15	50	–	–	–	–	–	–
	Total		**110**	**30**	**170**	**-**	**-**	**-**	**-**	**-**	**-**
Wheat	grain	80bu	100	45	49	2	16	8	0.06	0.18	0.28
Wheat	dtraw	2.0 tons	34	9	113	12	8	12	0.02	0.32	0.10
	Total		**134**	**54**	**170**	**14**	**24**	**20**	**0.08**	**0.50**	**0.38**
Hay											
Alfalfa		4 tons	180	40	180	112	12	19	0.06	0.44	0.42
Bluegrass		2 tons	60	20	60	16	7	5	0.02	0.30	0.08
Coastal bermudagrass		8 tons	300	70	270	59	24	35	0.21	–	–
Red clover		2.5 tons	100	25	100	69	17	7	0.04	0.54	0.36
Soybean		2 tons	90	20	50	40	18	10	0.04	0.46	0.15
Timothy		2.5 tons	60	25	95	18	6	5	0.03	0.31	0.20
Fruits, Vegetables											
Apples		500 bu	30	10	45	8	5	10	0.03	0.03	0.03
Cabbage		20 tons	130	35	130	20	8	44	0.04	0.10	0.08
Grapes	fruit	5 tons	15	10	25	–	–	–	–	–	–
Grapes	leaves & wood		20	5	20	–	–	–	–	–	–
	Total		**35**	**15**	**45**	**-**	**-**	**-**	**-**	**-**	**-**

Table 3. Nutrient removal by crops. (cont.)											
Crop	Plant Part	Acre yield	N	P as P_2O_5	K as K_2O	Ca	Mg	S	Cu	Mn	Zn
Muskmel-on	fruit	7 tons	30	11	60	–	–	–	–	–	–
Muskmel-on	vines	1.5 tons	20	5	30	–	–	–	–	–	–
	Total		**50**	**15**	**90**	**-**	**-**	**-**	**-**	**-**	**-**
Peaches		600bu	35	20	65	4	8	2	–	–	0.01
Potatoes	tubers	400 bu	80	30	150	3	6	6	0.04	0.09	0.05
Sweet potatoes	roots	300 bu	45	15	75	4	9	6	0.03	0.06	0.03
Tomatoes	fruit	20 tons	120	40	160	7	11	14	0.07	0.13	0.16

Table 4. Plant nutrient sufficiency ranges for field, forage, fruit, and nut crops.*											
Crop**	N	P	K	Ca	Mg	Mn	Fe	B	Cu	Zn	Mo
Field, Forage	%					%					
Alfalfa	4.50-5.00	0.35	2.20	0.80	0.40	25	30	15	7	15	0.5
Bermudagrass	2.00-3.00	0.20-0.50	1.50-2.50	0.25-0.75	0.15-0.50	50-250	50-300	5-20	6-20	20-50	-
Corn-up to 12" tall	3.50-5.00	0.30-0.50	3.00-4.00	0.30-0.70	0.20-0.60	30-300	50-250	4-25	3-20	20-60	0.2
Corn-ear leaf at silk or leaf below whorl	3.00-3.50	0.25-0.45	2.00-2.75	0.25-0.80	0.20-0.50	30-200	50-300	3-20	3-20	20-60	0.2
Cotton	3.50-4.50	0.30-0.50	2.00-3.00	2.25-3.00	0.50-0.90	50-350	50-250	20-60	8-20	20-60	–
Peanut	3.50-4.50	0.25-0.50	2.00-3.00	1.25-2.00	0.30-0.80	50-350	50-300	25-60	-	20-50	0.5
Small grains	4.00-5.00	0.20-0.40	1.50-3.00	0.20-0.50	0.15-0.50	25-100	25-100	3-20	5-25	20-70	–
Soybeans	4.25-5.00	0.30-0.50	1.75-2.50	0.50-1.50	0.25-0.80	20-200	50-300	25-60	6-30	20-50	0.5
Tobacco	3.50-4.25	0.25-0.50	2.50-3.20	1.50-3.50	0.20-0.65	30-250	50-200	20-50	15-60	20-80	–
Fruit, Nut											
Apple	2.00-3.00	0.15-0.50	1.25-3.00	1.00-2.00	0.20-0.50	20-200	50-400	20-60	5-20	15-50	–
Blueberry	1.80-2.00	0.10-0.20	0.40-0.60	0.30-0.75	0.20-0.30	20-200	60-150	10-50	10-20	10-50	–
Cherry	2.00-3.00	0.15-0.50	1.25-2.50	1.50-2.50	0.20-0.50	20-200	50-400	20-60	5-20	15-50	–
Grape	0.80-1.00	0.20-0.50	1.50-2.50	1.75	0.40-0.80	30-200	30	40-60	5-20	20-50	–
Peach	2.75-3.50	0.25-0.50	1.20-2.50	1.50-2.50	0.20-0.50	20-200	60-400	20-100	5-20	15-50	–
Pear	2.20-3.00	0.15-0.50	1.00-3.00	1.00-2.00	0.20-0.50	20-200	50-400	20-60	5-20	15-50	–
Pecan	2.50-3.90	0.12-0.30	1.00-1.50	0.70-1.50	0.30-0.60	100-800	50-300	20-45	10-30	50-100	–

*In general, if leaf composition is less than the lower value, yields may be reduced and deficiency symptoms may be visible. When leaf composition values are greater than the upper value, in some cases yields may be reduced and toxicity symptoms may be visible. It should be noted that temperature, moisture, and other factors also influence plant nutrient levels and sometimes make the interpretation of results difficult. Where possible, tissue analysis results should be compared between problem and normal growth areas and also compared with soil test results before a diagnosis is made. Information on crop management (planting time, depth, etc.) should also be included in the diagnosis.

**Sufficiency ranges are only applicable to the plant part and time of sampling specified in Tables 1 and 2. These values do not apply to other plant parts or times of sampling.

Table 5. Plant nutrient sufficiency ranges for vegetable crops and turf.										
Crop*	N	P	K	Ca	Mg	Mn	Fe	B	Cu	Zn
Vegetable			%					%		
Asparagus	2.4-3.8	0.30-0.35	1.5-2.4	0.40-0.50	0.15-0.20	10-160	-	50-100	-	20-60
Beet	3.5-5.0	0.20-0.30	2.0-4.0	2.5-3.5	0.30-0.80	70-200	-	60-80	-	15-30
Broccoli	3.2-5.5	0.30-0.70	2.0-4.0	1.2-2.5	0.23-0.40	25-150	100-300	30-100	1-5	45-95
Brussels sprout	2.2-4.2	0.26-0.45	2.4-3.4	0.3-2.2	0.23-0.40	-	-	30-40	-	-
Cabbage	3.0-4.0	0.30-0.50	3.0-4.0	1.5-3.5	0.25-0.45	-	30-60	30-60	-	20-30
Cantaloupe	2.0-3.0	0.25-0.40	1.8-2.5	5.0-7.0	1.0-1.5	-	-	30-80	-	30-50
Cauliflower	3.0-4.5	0.54-0.72	3.0-3.7	0.72-0.79	0.24-0.26	-	-	-	-	43-59
Collards	4.0-5.0	0.30-0.60	3.0-4.0	3.0-4.0	-	-	-	50-80	-	-
Cucumber	-	-	-	-	-	-	-	50-80	-	20-40
Green beans	3.0-6.0	0.25-0.50	1.8-2.5	0.8-3.0	0.25-0.70	30-300	300-450	40-60	15-30	30-60
Kale	4.0-5.0	0.30-0.60	3.0-4.0	3.0-4.0	-	-	-	50-80	-	-
Onion	1.5-2.5	0.25-0.40	-	-	-	-	-	30-45	-	10-15
Peas	3.1-3.6	0.30-0.35	2.2-2.8	1.2-1.5	0.27-0.35	-	-	20-60	-	-
Peppers, bell	3.0-4.5	0.30-0.70	4.0-5.4	0.4-0.6	1.0-1.7	-	-	40-100	10-20	-
Potatoes, Irish	3.0-5.0	0.20-0.40	4.0-8.0	2.0-4.0	0.5-0.8	30-50	70-150	30-40	-	20-40
Spinach	4.0-6.0	0.30-0.50	3.0-4.0	0.6-1.0	1.6-1.8	30-60	220-245	40-60	5-7	50-75
Sweet corn-ear leaf at silk	2.6-3.5	0.20-0.30	1.8-2.5	0.15-0.30	0.20-0.30	-	-	20-30	-	-
Sweet potato	3.2-4.2	0.20-0.30	2.9-4.3	0.75-0.95	0.40-0.80	40-100	-	-	-	-
Tomato, mech. harvest	3.0-6.0	0.50-0.80	2.5-4.0	0.6-0.9	60-100	-	40-80	4-8	15-30	
Turnip greens	3.5-4.5	0.35-0.60	-	3.0-5.0	-	60-80	-	30-60	-	-
Watermelon	2.0-3.0	0.20-0.30	2.5-3.5	2.5-3.5	0.6-0.8	-	-	-	4-8	-
Turf										
KY bluegrass	2.2-3.8	0.30-0.55	1.8-3.0	0.75-1.35	0.25-0.50	150-400	100-200	10-30	10-20	35-45

*Nutrient ranges apply only to the plant part and time of sampling specified in Table 2. These values do not apply to other plant parts or times of sampling.

Table 6. General crop nutrient deficiency symptoms.

Nutrient	Deficiency Symptoms
Nitrogen (N)	Restricted growth of tops and roots; growth upright and spindly; leaves pale and yellowish-green in early stages, more yellow and even orange or red in later stages; deficiency shows up first on lower leaves.
Phosphorus (P)	Restricted growth of tops and roots; growth is upright and spindly; leaves bluish-green in early stages with green color sometimes darker than plants supplied with adequate phosphorus; more purplish in later stages with occasional browning of leaf margins; defoliation is premature, starting at the older leaves.
Potassium (K)	Browning of leaf tips; marginal scorching of leaf edges; development of brown or light colored spots in some species which is usually more numerous near the margins; deficiency shows up first on lower foliage.
Calcium (Ca)	Deficiency occurs mainly in younger leaves near the growing point; younger leaves distorted with tips hooked back and margins curled backward or forward; leaf margins may be irregular and display brown scorching or spotting.
Magnesium (Mg)	Interveinal chlorosis with chlorotic areas separated by green tissue in earlier stages giving a beaded streaking effect; deficiency occurs first on lower foliage.
Sulfur (S)	Younger foliage is pale yellowish-green, similar to nitrogen deficiency; shoot growth somewhat restricted.
Zinc (Zn)	Interveinal chlorosis followed by die back of chlorotic areas.
Manganese (Mn)	Light green to yellow leaves with distinctly green veins; in severe cases, brown spots appear on the leaves and the leaves are shed; usually begins with younger leaves.
Boron (B)	Growing points severely affected; stems and leaves may show considerable distortion; upper leaves are often yellowish red and may be scorched or curled.
Copper (Cu)	Younger leaves become pale green with some marginal chlorosis.
Iron (Fe)	Interveinal chlorosis of younger leaves.
Molybdenum (Mo)	Leaves become chlorotic, developing rolled or cupped margins; plants deficient in this element often become nitrogen deficient.
Chlorine (Cl)	Deficiency not observed under field conditions.

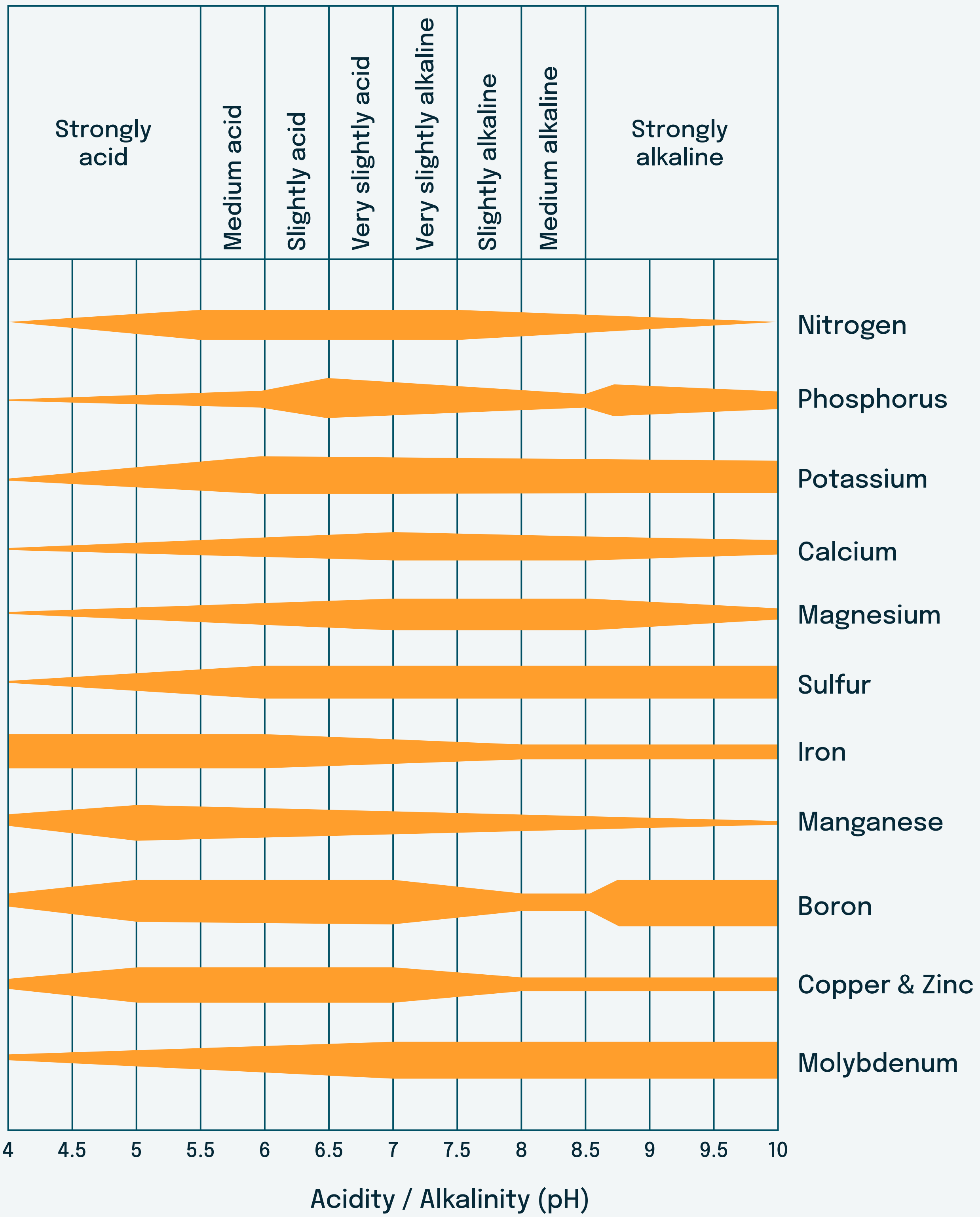


Figure 1. Relationship between soil pH and the availability of minerals that are essential for plant growth.

Soil Testing Lab Conversion Factors

Periodically, Virginia Cooperative Extension receives requests for information on the interpretation of soil test results from laboratories that use procedures that differ from ours. Very simply, different procedures usually extract different amounts of nutrients from the soil. However, any good soil testing procedure, when properly correlated with plant growth, can be used as a basis for making fertilizer recommendations. In the Virginia Tech Soil Testing Laboratory, we use the Mehlich 1 (0.05N HCl + 0.025N H_2SO_4) soil test procedure to extract both phosphorus and potassium because we have done considerable research to correlate the test results obtained by this method with plant growth. Other procedures, however, could extract more or less nutrients than the Mehlich 1 procedure does, and therefore, values obtained by these other methods cannot be used directly to make fertilizer recommendations. **They must first be converted to equivalent Virginia Tech test levels.**

The following are **conversion factors** for converting private and other state lab phosphorus and potassium test results to Virginia Tech test values. The conversion factors are approximate values only, and they vary depending on soil type, type of clay, past fertilization, etc. However, they should put one in the ballpark with respect to Virginia Tech test levels.

1. **Converting Bray P_1 (weak) phosphorus to Virginia Tech Mehlich 1 phosphorus.**

pH < 5.6	Weak Bray P, ppm x 0.6 = Virginia Tech P, ppm	Weak Bray P, ppm x 1.2 = Virginia Tech P, lb/A
pH 5.6-6.2	Weak Bray P, ppm x 0.7 = Virginia Tech P, ppm	Weak Bray P, ppm x 1.4 = Virginia Tech P, lb/A
pH 6.3-6.9	Weak Bray P, ppm x 0.8 = Virginia Tech P, ppm	Weak Bray P, ppm x 1.6 = Virginia Tech P, lb/A
pH > 6.9	Weak Bray P, ppm x 1.2 = Virginia Tech P, ppm	Weak Bray P, ppm x 2.4 = Virginia Tech P, lb/A

2. **Converting ammonium acetate potassium to Virginia Tech Mehlich 1 potassium.**

Ammonium acetate K, ppm x 0.67 = Virginia Tech K, ppm
Ammonium acetate K, ppm x 1.33 = Virginia Tech K, lb/A

3. **Converting Mehlich 3 phosphorus to Virginia Tech Mehlich 1 phosphorus.**

   Preliminary research indicates that, for Mid-Atlantic soils, the Mehlich 3 phosphorus procedure extracts approximately the same amount of phosphorus as the Bray P_1 (Weak Bray) procedure. Therefore, use the same conversion factor as given for Bray P_1 to convert Mehlich 3 phosphorus to Virginia Tech phosphorus.

4. **Converting Mehlich 3 potassium to Virginia Tech Mehlich 1 potassium.**

   Preliminary research indicates that, for Mid-Atlantic soils, the Mehlich 3 potassium procedure extracts approximately the same amount of potassium as the ammonium acetate procedure. Therefore, use the same conversion factor as given for ammonium acetate to convert Mehlich 3 potassium to Virginia Tech potassium.

5. Calibration of phosphorus (P) and potassium (K) tests, Virginia Tech Soil Testing Laboratory.

Soil Test P	lb/A	P-ppm
L-	0-3	0-2
L	4-8	2-4
L+	9-11	5-6
M-	12-20	6-10
M	21-30	11-15
M+	31-35	16-18
H-	36-55	18-28`
H	56-85	28-43
H+	86-110	43-55
VH	110+	55+

Soil Test K	lb/A	P-ppm
L-	0-15	0-8
L	16-55	8-28
L+	56-75	28-38
M-	76-100	38-50
M	101-150	51-75
M+	151-175	76-88
H-	176-210	88-105
H	211-280	106-140
H+	281-310	141-155
VH	310+	155+

6. Other useful conversion factors are available in Part IX on pages 138-140 and in Part X on page 142.

Conversion factors				
P	×	2.3	=	P_2O_5
P_2O_5	×	0.44	=	P
K	×	1.2	=	K_2O
K_2O	×	0.83	=	K
ppm	×	2.0	=	lbs/A
lbs/A	×	0.5	=	ppm