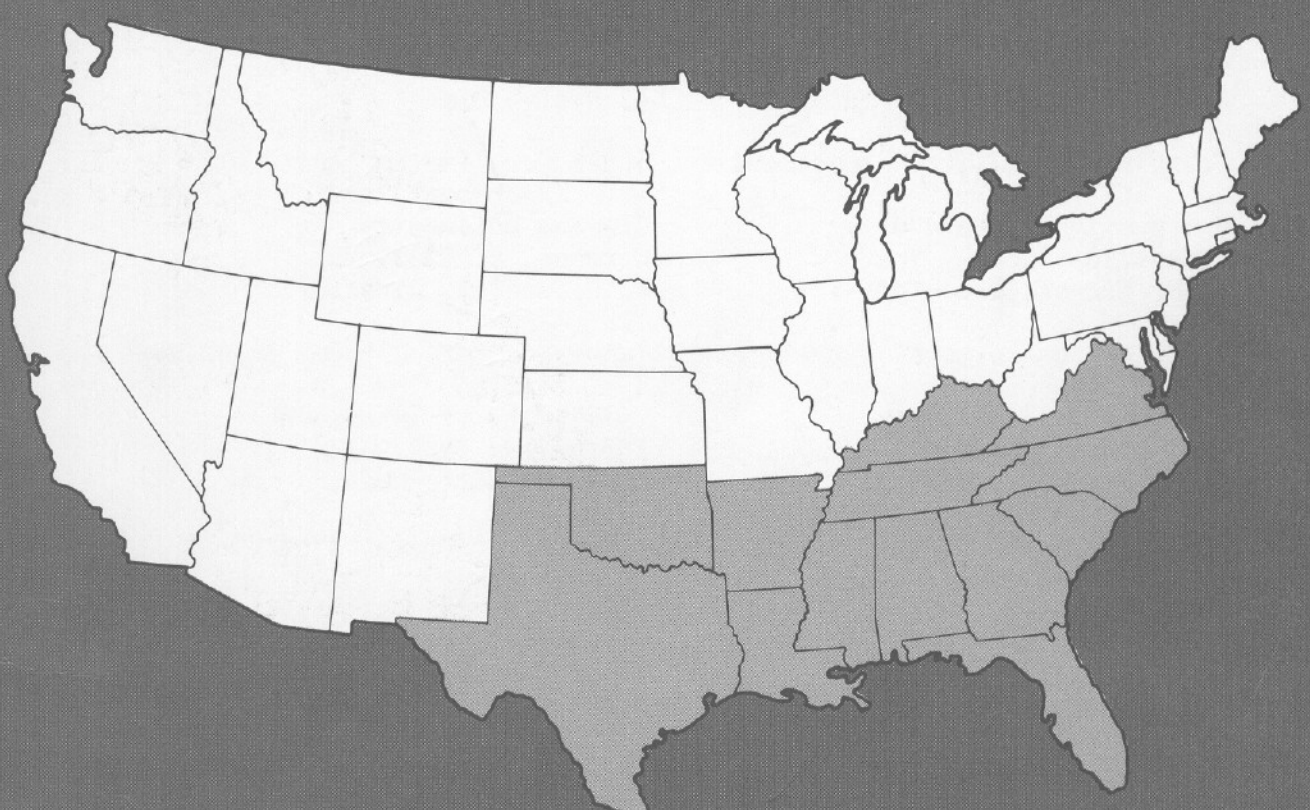
PROCEDURES USED BY STATE SOIL TESTING LABORATORIES IN THE SOUTHERN REGION OF THE UNITED STATES



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Most of the 13 Southeastern States have made major changes in their soil testing procedures since the last publication in 1974. The Southern Regional Soil Testing and Plant Analysis Research Information Exchange Group (formerly Southern Soil Test Work Group) began revision in 1982 with the final publication being completed in 1984. The procedures described are used by the various state soil testing laboratories to test samples in their respective states, the results to serve as a basis for lime and fertilizer recommendations. Copies of this bulletin may be obtained by state residents from their Agricultural Experiment Station office.

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PROCEDURES USED by STATE SOIL TESTING LABOROTORIES in the SOUTHERN REGION of the UNITED STATES

Introduction

This Bulletin is the second revison of the "Southern Cooperative Series Bulletin No. 102" (1) published in June, 1965 Bulletin 102 described in some detail the various soil testing procedures used at that time by the 13 Southeastern States. It, and the first revison (2), served as a reference to those interested in soil test methods applicable to soils similar to those found in this region.

Since there have been many changes in soil testing since the last revision, another revision describing the current status of soil testing in the Southeast became necessary. This bulletin was prepared by members of the Southern Regional Research Information Exchange Group on Soil Testing and Plant Analysis (formerly the Southern Soil Test Work Group). It briefly describes laboratory procedures currently in use in the 13 Southeastern States (Alabama, Arkansas, Florida, Geogia, Kentucky, Louisiana, Mississippi, North Carolina, Oklahoma, South Carolina, Tennessee, Texas, and Virginia). Interpretative data related to the various tests are also given. No attempt is made to describe in detail all the procedures used for each element and test. Details in methodology change frequently with the introduction of new instrumentation and analytical techniques. A recent regional publication describes reference soil testing methods for the Southern Region (3). Detailed procedures for a specific state may be obtained directly from the state representative. Only those determinations which constitute the routine test in most laboratories are described in any detail. References to primary sources are given when applicable.

Soil testing is recognized as an effective means of determining rapidly and routinely the lime and fertilizer requirements for a particular soil-cropping situation. In general, southern soils are inherently low in fertility and pH and require sizable amounts of applied fertilizer and lime to be made productive. When brought into intensive cultivation, frequent applications of fertilizer and lime are needed to maintain most of these soils in a highly productive state. Soil tests can be used both to prescribe corrective lime and fertilizer treatments and to monitor the soil's fertility status.

The soil test procedures described here have been adopted for various reasons. The most important considerations were acceptable reliability, laboratory convenience, and personal preference. Although several methods are employed within the region, there is considerable uniformity in methodology, particularly in those states of the Coastal Plain and Piedmont regions. Increased uniformity in methodology and recommendations among states having similar soils is a continuing goal.

SOIL TEST DETERMINATIONS

All 13 states routinely determine water pH, and extractable P and K for all soils submitted for analysis. Most states routinely provide additional tests such as extractable Ca and Mg. A number of other determinations can be obtained upon request. Tests for organic matter, soluble salts, and extractable B, Mn, Zn, Fe, Cu, Na, and NO_3-N are available in several laboratories upon request. Determinations for texture, oil content, as well as As, S, and NH_4-N content are offered by some. Eleven laboratories provide a chemically determined lime requirement; the others estimate the lime requirement (see Table 4). A list of specific tests offered by the various state soil testing laboratories is given in Table 1.

SAMPLE PREPARATION

In general, soil samples are dried prior to analysis at ambient or slightly higher air temperatures. Soils are crushed by various mechanical devices and screened to pass either a 9- or 20-mesh (2.00 or 0.84 mm) sieve. A description of the sample preparation procedures used by the various state soil testing laboratories is given in Table 2.

SOIL-WATER pH

All states use potentiometers with glass electrodes for determining soil-water pH. All but 3 states use a soil:water ratio of 1:1; Florida, Mississippi, and Texas use 1:2 soil:water ratio. Samples are either weighed or measured, water added, and allowed to stand from 10 minutes to 2 hours prior to determining the pH. A description of the soil-water pH determination procedures is given in Table 3.

LIME REQUIREMENT

Texas and Virginia estimate lime requirement based primarily on pH and other known soil characteristics and plant requirements. Most laboratories, however, use a chemical test for determining lime requirement. Various buffer systems, including the Adams-Evans (4), Shoemaker-McLean-Pratt (SMP) (5), as well as other buffer and titration systems are used. The Adams-Evans buffer system is primarily an adaptation of the SMP buffer, but designed specifically for the sandy soils of the Coastal Plain region. The various methods used for determining lime requirement are given in Table 4.

EXTRACTABLE ELEMENTS

Several different extracting reagents are employed to determine the level of extractable nutrient elements in southeastern soils. The 0.05 N HCl in 0.025 N H_2SO_4 extractant (Mehlich I) is used in six states for determining extractable P, K, Ca, and Mg (6). These states are located primarily in the Coastal Plain area of the southeast, where the soils are acid, sandy textured, containing little organic matter, and have low cation exchange capacities (less than 10 meq/100g). Some states use 0.03 N NH_4F in 0.025 N HCl (7) (Bray-Kurtz #1) for P and 1 N NH_4OAc,pH

7.0 (8) for exchangeable K, Ca, and Mg. Louisiana, Mississippi, and Texas use other extracting solutions.

Phosphorus

Six states remove extractable P from soil with the Mehlich I (0.05 N HCl in 0.025 N H_2SO_4) solution; two states, modified Bray P_1 (0.03 N NH_4F in 0.025 N HCl); one state, modified Bray P_2 (0.03 N NH_4F in 0.1 N HCl (10); two states, the recently developed Mehlich III; and the remaining two states use other extraction procedures. Two states weight samples, eight use measured volume to obtain an estimated weight, and the remaining three measure to a specific volume. Soil-solution ratios and shaking times vary depending upon the method, with some variation within the same method. Twelve states use the molybdenum blue colorimetric procedure (11); the remaining state, Georgia, uses induction coupled plasma (ICP) spectrometry. A tabulation of procedures for determining extractable P is given in Table 5.

Potassium, Calcium, and Magnesium

All states use a single extraction to obtain K, Ca, and Mg from soils. Six states use the Mehlich I (0.05 N HCl in 0.025 N H_2SO_4) solution; three states use neutral normal ammonium acetate extraction; two states use the Mehlich III; and the remaining two states use other specialized solutions.

All states use atomic absorption flame spectroscopy for analysis of Ca and Mg, except Georgia, which uses ICP for all three elements. Six states also use atomic absorption for K analysis while the other six use flame emission photometry. A tabulation of procedures for determining extractable K, Ca, and Mg is given in Table 6.

OTHER DETERMINATIONS

All states offer other specific tests upon request. Tests for organic matter, soluble salts, and level of B, Mn, Zn, Fe, Cu, Na, and NO_3-N are among these. Methodology varies considerably due to the nature of the test itself, analytical techniques, and instrumentation. Several of the test procedures are widely used. For example, organic matter is usually determined by wet oxidation (12), Zn by the Mehlich I extraction procedure (13) or 0.01 N HCl (14), and soluble salts on a 1:2 soil:water extraction (15). Since these methods are related specifically to each laboratory and soil region, they are not described in this bulletin.

SOIL TEST INTERPRETATION

The value of a soil test is determined primarily by the accuracy of the resulting fertilizer or lime recommendation. A good soil test should meet two basic requirements: (1) it should give a result that can be closely correlated with nutrient availability in soils as measured by reliable techniques; and (2) it should be calibrated against crop response according to the percent yield concept of Bray (16), or some other interpretation that reflects the degree of deficiency and/or fertilizer requirement at different soil test values (17).

Since crops vary in their requirement for nutrients and soils vary in their capacity to supply nutrients at specific soil test values, calibration of soil tests is complex, requiring much field research and laboratory study. Unfortunately, adequate calibration data are not available for all soils and crops in all states.

The procedure followed by most laboratories in progressing from a soil-test value to a fertilizer recommendation involves: (1) rating the soil-test value; and (2) making a fertilizer recommendation based on that rating.

A rating scale commonly employed by most southeastern soil test laboratories classifies soil as being very low (VL), low (L), medium (M), high (H), or very high (VH) in a particular plant nutrient, such as P or K. Such a rating imples a specific definition on some basis. It may be on the basis of nutrient sufficiency for crops in general or in terms of the relative crop yield without fertilization. An example of the definition used by Florida, and which is typical for other states, follows:

Very low -- Less than 50% of crop yield potential is expected without addition of the nutrient. Yield increase to added nutrient is always expected.

Low ------- 50 to 75% of crop yield potential is expected without addition of the nutrient. Yield increase to added nutrient is expected.

Medium ---- 75 to 100% of crop yield potential is expected without addition of the nutrient. Yield increase to added nutrient is expected, especially if test value is in lower end of range.

High ------ Soil can supply sufficient quantities of the nutrient for the crop. Yield increase to added nutrient is not expected. Test again next year if the nutrient is not applied.

Very high - Soil can supply the nutrient in far greater quantities than considered adequate. Yield increase to added nutrient is never expected. Addition of P or K will be wasteful, could induce nutrient imbalances, and could decrease yields.

Rates of fertilization required at each rating are influenced by the crop and its yield, the nutrient source, the time and method of application, and whether accelerated soil fertility buildup is desired. Expression of soil test results as parts per million or pounds per acre is of little value to growers unless interpreted in terms of crop response and fertilizer needs.

Soil test extractants usually do not remove all of the available nutrients from the soil, nor do different extractants remove identical amounts. Therefore, results from different laboratories cannot be compared directly with each other except by using the same rating system for a given crop, or group of crops, or by regression analysis. The best way to compare results from different laboratories is to compare recommendations for specific crops based on analyses of carefully selected uniform soil samples by the different laboratories.

The ratings for P and K used by the 13 Southern States laboratories along with the associated soil test values are presented in Table 7. It should be noted that Arkansas, North Carolina, Oklahoma, Texas, Tennessee, and Virginia use a single rating scale for all soils and crops, whereas the other states use two or more rating scales. In the latter case, subdivision is based on soil characteristics involving primarily soil texture and/or cation exchange capacity. In Alabama, Georgia, Kentucky, and Mississippi ratings for K are further subdivided based on variation in crop response. The fact that many states use only one rating scale for all crops and soils should not be construed to indicate that the effect of soil properties or variation in crop response is not taken into account in making fertilizer recommendations. Each state has developed guidelines, either published or unpublished, for making lime and fertilizer recommendations based on its soil testing procedures. Anyone interested in the interpretation of soil tests and fertilizer recommendations made by a given state laboratory should contact the state laboratory involved.

Uniformity of the ratings among laboratories using the same procedures may be noted from these data, as well as the degree of precision attempted. Soil test values on which ratings are based are similar for the same methods in most cases, but closer agreement is desirable and should be obtained with more definitive soil test calibration and adoption of a uniform system for establishing the ratings.

Ratings for Ca and Mg are shown in Table 8. As with P and K, many of the states use a single rating for all crops and soils, but some subdivide based on soil properties and/or variation in crop response. Ratings are based both on soil test values and percent saturation. In many instances where a single rating is employed, it may be based primarily on a single requirement, such as the amount of Ca that must be absorbed directly from the soil by a peanut pod during its development.

An examination of the soil test values used to establish ratings for Ca and Mg shows the magnitude of variation among laboratories using the same or similar testing procedures. This variation apparently reflects a need for more definitive work on soil test calibration, at least in, or among these states, as well as adoption of a uniform system for establishing ratings.

Some states use a numerical fertility index to help growers interpret results of soil tests. Alabama uses an index based on percentage sufficiency ranging from 0 to 9990. North Carolina uses an index arbitrarily scaled from 0 to 100+. The objectives of using indexs are: (1) to report all nutrients on a common basis, (2) to provide a quantitative result that can be used in keeping records of soil fertility build-up or depletion.

The use of descriptive or alphabetical ratings (VL, L, M, H, VH) constitutes a form of indexing also, but does not possess the quantitative aspects of a numerical index.

SUMMARY

This bulletin gives a brief description of the soil test methods used by the 13 Southestern States to test soil samples for: (1) lime and fertilizer recommendations, (2) fertility evaluation.

Only the procedures for determining soil pH, extractable P, K, Ca, Mg, and lime requirement, are given in any detail. Those needing more specific information should contact the individual state laboratory or refer to the references cited. Interpretative data used by the different state laboratories for evaluation of soil for the four extractable elements, P, K, Ca, and Mg are included.

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Table 1. Determinations Made Routinely and Upon Request

State	Water pH	Lime requirement	Organic matter	Extactable elements: P	K	Ca	Mg	B	Mn	Zn	Fe	Cu	Na	NO_3	Soluble Salts	Salinity	Texture
Alabama	0	0	X	0	0	0	0		X	X				X	X		
Arkansas	0	0	X	0	0	0	0	X	X	X	X	X	0	X	X		
Florida	0	0	X	0	0	0	0		X	X		X			X		
Georgia‡	0	0	X	0	0	0	0	X	X	X	X	X	X	X	X		X
Kentucky	0	0	X	0	0	X	X	X		X			X	X	X	X	X
Louisiana*	0	0	0	0	0	0	0	X	X	X	X	X	X	X	X		0
Mississippi+	0	0	X	0	0	0	0		X	0			X	X	X		
North Carolina‡	0	0	0	0	0	0	0		0	0		0	X	X	X		
Oklahoma+	0	0		0	0	X	X	X	X	X	X		X	0		X	
South Carolina**	0	0	X	0	0	0	0		X	X				X	X		
Tennessee	0	0	X	0	0	X	X		X	X	X				X		
Texas	0		X	0	0	0	0		X	X	X	X	0	X	0	X	
Virginia	0		X	0	0	0	0		X	X				X	X		

0 Determined on all soil samples. X Available on request. * Oil, S and As on request only.

+ S on request. ‡ NH_4-N and S on request only, Humic matter instead of organic matter. ** S routine on subsoil samples.

Table 2. Methods of Soil Sample Preparation

State	Drying procedures Time	Temperature	Crushing and screening procedures Method	NBS*
	Hr.	°F		Sieve No.
Alabama	24	135	Steel Hammermill	10
Arkansas				
Delta and Loesse soils	48	80	DYNA Crush	20
Upland soils	12	Ambient	Mortar and Pestle	20
Florida	Until dry	100	Screen only	10
Georgia	12	100	NASCO-Asplin Soil Grinder	10
Kentucky	12	100	NASCO-Asplin Soil Grinder	10
Louisiana	12-24	Ambient	BISCO type UA Pulverizer	10
Mississippi	Until air dry	Ambient	DYNA Crush	16
North Carolina	Until dry	10-15 Above ambient	DYNA Crush	10
Oklahoma	8	160	DYNA Crush	10
South Carolina	24	Ambient	NASCO-Asplin Soil Grinder	10
Tennessee	Until dry	Ambient	NASCO-Asplin Soil Grinder	10
Texas	16	Less than 100	Hammermill	10
Virginia	12-24	Ambient	DYNA Crush	10

*National Bureau of Standards sieve No. 10 is 9 mesh and has an opening of 2.00 mm, No. 20 is 20 mesh and has an opening of .841 mm.

Table 3. Methods for Determining Soil-Water pH

State	Sample size	Soil to water ratio	Standing time
			Min.
Alabama----------------	20 ml	1:1 (v/v)	60
Arkansas----------------	17 ml	1:1 (v/v)	30
Florida-----------------	25 ml	1:2 (v/v)	30
Georgia-----------------	20 ml	1:1 (v/v)	30
Kentucky----------------	9 ml	1:1 (v/v)	15
Louisiana---------------	30 ml*	1:1 (v/v)	120
Mississippi-------------	10 g*	1:2 (w/v)	20
North Carolina----------	10 ml	1:1 (v/v)	60
Oklahoma----------------	15 g*	1:1 (w/v)	30
South Carolina----------	20 g*	1:1 (w/v)	60
Tennessee---------------	10 g*	1:1 (w/v)	30
Texas-------------------	8 ml	1:2 (v/v)	30
Virginia----------------	20 ml	1:1 (v/v)	15

*Weight estimated by measuring specific volume.

Table 4. Methods for Determining Lime Requirement

State	Method Employed*
Alabama--------------------	Adams-Evans Buffer
Arkansas-------------------	pH and Ca Content
Florida--------------------	Adams-Evans Buffer
Georgia--------------------	Adams-Evans Buffer
Kentucky-------------------	SMP Buffer
Louisiana------------------	$Ca(OH)_2$ Incubation and Titration
Mississippi----------------	$CaCl_2$-NaOH, p-nitrophenol Buffer (modified Woodruff)
North Carolina-------------	Mehlich Buffer
Oklahoma-------------------	SMP Buffer
South Carolina-------------	Adams-Evans Buffer—modified
Tennessee------------------	Adams-Evans Buffer
Texas----------------------	Estimated from Water pH and Approximate Texture
Virginia-------------------	Estimated, Soils Grouped According to CEC for Recommendations

*Specific details related to each of these test methods can be obtained from each laboratory.

Table 5. SOIL SAMPLE SIZE, EXTRACTING REAGENT SOIL TO SOLUTION RATIO, SHAKING TIME, AND COLORIMETRIC PROCEDURE FOR DETERMINING SOIL TEST PHOSPHORUS

State	Sample size	Extracting reagent	Soil to solution ratio	Shaking time	Method of colorimetric determination
				Min.	
Alabama---------------------	5 g	Mehlich I: 0.05 N HCl in 0.025 N H_2SO_4	1:4 w/v	5	molybdenum blue
calcareous soils only----	5 g	Buffered Acidic (acetic-malic-malonic) AlF_3 sol'n at pH 4.0	1:4 w/v	10	molybdenum blue
Arkansas---------------------	1 g*	Bray and Kurtz P_1 0.03 N NH_4F in 0.025 N HCl	1:10 w/v	0.67	molybdenum blue
Florida---------------------	5 g*	Mehlich I	1:4 w/v	5	molybdenum blue
Georgia---------------------	5 g*	Mehlich I	1:4 w/v	5	ICP+
Kentucky---------------------	2 ml	Bray and Kurtz P_1	1:10 v/v	5	molybdenum blue
Louisiana------------------	2.5 g	0.03 N NH_4F in 0.1 N HCl	1:20 w/v	15	molybdenum blue
Mississippi-----------------	5.g*	Two-stage extraction Stage 1: soak 10 min in 5 ml 0.05 N HCl Stage 2 add 20 ml buffered acidic (acetic-malic-malonic) AlF_3 sol'n at pH 4.0	1:5 w/v	10	molybdenum blue
North Carolina-------------	2.5 ml	Mehlich III. 0.2N HoAC, 0.25 N NH_4NO_3, 0.015 N NH_4F, 0.013N HNO_3, 0.001 M EDTA	1:10 v/v	5	molybdenum blue
Oklahoma------------------	2 g*	Mehlich III	1:10 w/v	5	molybdenum blue
South Carolina------------	5 g*	Mehlich I	1:4 w/v	5	molybdenum blue
Tennessee------------------	5 g*	Mehlich I	1:4 w/v	5	molybdenum blue
Texas---------------------	1.7 ml	1.4 N NH_4OAc in 1 N HCl and 0.025 M EDTA adjusted to pH 4.2	1:20 (v/v)	60	molybdenum blue
Virginia---------------------	5 g*	Mehlich I	1:4 w/v	5	Molybdenum blue

*Weight estimated by measuring specific volume.

+Induction coupled plasma.

Table 6. SOIL SAMPLE SIZE, EXTRACTING REAGENT, SOIL TO SOLUTION RATIO, SHAKING TIME, AND ANALYTICAL PROCEDURE FOR DETERMINING SOIL TEST POTASSIUM, CALCIUM, AND MAGNESIUM

State	Sample size	Extracting reagent	Soil to solution ratio	Shaking time	Method of determination** (K, Ca, Mg)
				Min.	
Alabama	5 g	Mehlich I: 0.05 N HCl in 0.025 N H_2SO_4	1:4 w/v	5	AA/AA/AA
calcareous soils only	5 g	Buffered Acidic (acetic-malic-malonic) AlF_3 sol'n at pH 4.0	1:4 w/v	10	
Arkansas	3 g*	1 N NH_4OAc, pH 7.0	1:5 w/v	5	AA/AA/AA
Florida	5 g*	Mehlich I	1:4 w/v	5	FE/AA/AA
Georgia	5 g*	Mehlich I	1:4 w/v	5	ICP/ICP/ICP
Kentucky	5 g*	1 N NH_4OAc, pH 7.0	1:5 w/v	5	AA/AA/AA
Louisiana	2.5 g	1 N NH_4OAc, pH 7.0	1:20 w/v	15	AA/AA/AA
Mississippi	5 g	Two stage extraction - Stage 1: soak 10 min in 5 ml 0.05 N HCl, Stage 2: add 20 ml buffered acidic (acetic-malic-malonic) AlF_3 sol'n at pH 4.0	1:5 w/v	10	AA/AA/AA
North Carolina	2.5 ml	Mehlich III	1:10 v/v	5	FE/AA/AA
Oklahoma	2 g*	Mehlich III	1:10 w/v	5	AA/AA/AA
South Carolina	5 g*	Mehlich I	1:4 w/v	5	FE/AA/AA
Tennessee	5 g	Mehlich I	1:4 w/v	5	AA/AA/AA
Texas	1.7 ml	1.4 N NH_4OAc in 1.0 N HCl and 0.025 M EDTA adjusted to pH 4.2	1:20 v/v	60	FE/AA/AA
Virginia	5 g*	Mehlich I	1:4 w/v	5	FE/AA/AA

*Weight estimated by measuring specific volume.

**AA-Atomic Absorption; FE = flame emission; ICP = induction coupled plasma.

Table 7. Soil Test Values Used in Rating Soil Tests for Phosphorus and Potassium

State, soil and crop	Phosphorus, lb./acre					Potassium, lb./acre				
	VL	L	M	H	VH	VL	L	M	H	VH
				States Using Mehlich I						
ALABAMA										
Corn and other grasses, peanuts										
CEC 0-4.5 me/100g--------------	0-12	13-25	26-50	51-100	101+	0-20	21- 40	41- 80	81-160	161+
CEC 4.6-9.0 me/100g------------	0-12	13-25	26-50	51-100	101+	0-30	31- 60	61-120	121-240	241+
CEC 9.1+ me/100g--------------	0- 7	8-15	16-30	31- 60	61+	0-40	41- 80	81-160	161-320	321+
Calcareous soils(Miss.Extract)	0-18	19-36	37-72	73-144	145+	0-50	51-120	121-190	191-320	321+
Cotton, legumes, gardens, lawn, shrubs, etc.										
CEC 0-4.5 me/100g--------------	0-12	13-25	26-50	51-100	101+	0-30	31- 60	61-120	121-240	242+
CEC 4.6-9.0 me/100g------------	0-12	13-25	26-50	51-100	101+	0-45	46- 90	91-180	181-360	361+
CEC 9.1+ me/100g--------------	0- 7	8-15	16-30	31- 60	61+	0-60	61-120	121-240	241-480	481+
Calcareous soils(Miss.Extract)	0-18	19-36	37-72	73-144	145+	0-80	81-160	161-240	241-480	481+
FLORIDA---------------------------	0-17	18-34	35-60	61-120	121+	0-37	38- 75	76-125	126-250	251+
GEORGIA										
Field, grass crops, and lawns										
Coastal Plain-------------------		0-30	31-60	61-100	101+		0- 60	61-150	151-250	251+
Other soils---------------------		0-20	21-40	41- 75	76+		0-100	101-200	201-350	351+
Legumes, Gardens										
Coastal Plains-----------------		0-30	31-60	61-100	101+		0- 70	71-170	171-275	276+
Other soils---------------------		0-20	21-40	41- 75	75+		0-120	121-250	251-400	401+
Shrubs, etc.										
All soils		0-50	51-100	101-200	201+		0-150	151-250	251-450	451+
SOUTH CAROLINA										
Coastal Plain-------------------	0-10	11-30	31-60	61-120	121+	0-24	25- 70	71-156	157-234	235+
Piedmont------------------------	0- 6	7-20	21-40	41- 80	81+	0-24	25- 70	71-156	157-234	235+
TENNESSEE-------------------------		0-18	19-30	31-120	121+		0- 90	91-160	161-320	321+
VIRGINIA--------------------------		0-11	12-35	36-110	111+		0- 75	76-175	176-310	311+

Table 7. (Cont.).

State, soil and crop	Phosphorus, lb./acre					Potassium, lb./acre				
	VL	L	M	H	VH	VL	L	M	H	VH
				States Using Mehlich III						
NORTH CAROLINA------------------	0-21	22-53	54-107	108-214	215+	0-35	36-87	88-174	175-348	349+
OKLAHOMA------------------------	Continuous, 0 to 65, 40 critical					Continuous, 0 to 250, 200 critical				
				States Using Bray and Kurtz P_1						
ARKANSAS------------------------	0-21	22-43	44-87	88+		0-70	71-150	151-250	251-	
KENTUCKY										
Tobacco------------------------		0-30	31-60	61- 80	81+		0-165	166-250	251-375	376+
Soybeans-----------------------	0-10	11-30	31-60	61+		0-75	76-165	166-250	251+	
All others---------------------		0-30	31-60	61+			0-165	166-250	251+	
				States Using Other Procedures						
LOUISIANA										
Coastal Plain------------------	4	0- 80	81-160	161+			0-120	121-200	201-	
Flatwood-----------------------	6	0- 70	71-140	141+			0-160	161-240	241+	
Miss Terraces------------------	8	0- 70	71-140	141+			0-200	201-280	281+	
Coastal Prairies---------------	10	0- 70	71-140	141+			0-240	241-320	321+	
Alluvial vfsl------------------	10	0-120	121-240	241+			0-240	241-320	321+	
Alluvial clay------------------	25	0-160	161-320	321+			0-480	481-720	721+	
MISSISSIPPI*--------------------	0-18	19- 36	37- 72	73-108	109+	0-150	40-260	80-320	120-560	210+-560+
TEXAS---------------------------	0-10	11-20	21-40	41- 80	81+	0-180	181-260	261-350	351-600	60+

*Potassium rating varies with CEC and crop.

Table 8. Soil-Test Values Used in Rating Soil Tests for Calcium and Magnesium

State, soil and crop	Calcium, lb./acre L	M	H	Magnesium, lb./acre L	M	H
			States Using Mehlich I			
ALABAMA						
Peanuts, all soils					All crops	
Coastal Plain--------	0-175	176-300	301+	0- 25		26+
Other soils----------				0- 50		51+
Tomatoes, all soils	0-300	301-500	501+			
FLORIDA		No rating		0- 30	31- 60	61+
GEORGIA						
Coastal Plain--------	0-200		201+	0- 60		61+
Other soils----------	0-400		401+	0-120		121+
SOUTH CAROLINA	0-400	401-800	801+	Coastal Pl. 0- 32	33- 60	61+
				Piedmont 0-46	47-100	101+
VIRGINIA	0-720	721-1440	1441-2160	0- 72	73-144	145-216
			States Using Other Extracting Reagents			
ARKANSAS		No rating			No rating	
KENTUCKY		No rating		0- 40	41-80	81+
LOUISIANA, CEC, meq/100 g						
Coastal Plains-----4	0-1,000	1,001-1,400	1401+	0-100	101-140	141+
Flat woods---------6	0-1,400	1,401-2,000	2001+	0-140	141-200	201+
Miss. Terraces-----8	0-2,000	2,001-2,600	2601+	0-200	201-260	261+
Coastal Prairies--10	0-2,400	2,401-3,200	3201+	0-240	241-320	321+
Alluvial vfsl-----10	0-2,600	2,601-3,200	3201+	0-260	261-320	321+
Alluvial clay-----25	0-6,400	6,401-8,000	8001+	0-640	641-800	801+

MISSISSIPPI						
Peanuts, all soils	0-250	251-500	501+			
CEC 5--------------				0- 20	21- 40	41+
CEC 5--------------				0-1.75%*	1.76-3.30%*	3.31%*
NORTH CAROLINA	Rating based on percentage saturation of Ca and Mg					
OKLAHOMA	0-750		750+	0-100		100+
TENNESSEE						
Tomatoes, peppers,	deficient	sufficient	deficient	sufficient		
Grapes, cabbage						
Tobacco, ornamentals	0-500	501+	0-40	41+		
TEXAS	0-500	501-1500	1501-4000	0-100	101-300	301+

*Percent Mg saturation for cotton.