



Virginia Cooperative Extension
Virginia Tech • Virginia State University

SOIL TEST RECOMMENDATIONS for VIRGINIA

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INTRODUCTION

The Soil Testing Laboratory at Virginia Tech began operations in 1938. It was established primarily to assist farmers and homeowners in determining the proper amounts of fertilizer and lime to apply. Since the lab opened, sample numbers have increased from 2,500 samples per year in 1938 to approximately 55,000 samples per year today. The lab was computerized in 1980, underwent significant modification in analytical technique with the addition of a simultaneous nutrient analyzer system in 1986, and the computer system was upgraded further in 1988, 1993 and 1999.

Fertilizer and lime recommendations have been revised over the years as new research information has become available. In 1993, recommendations for the major agronomic crops were thoroughly reviewed and revised, and new recommendations were developed. Additionally, work was completed on a new recommendation system for corn, soybeans, and wheat called "**VALUES**", the Virginia Agronomic Land Use Evaluation System. VALUES updates are reflected in the Department of Conservation and Recreation's Virginia Nutrient Management Standards and Criteria, www.dcr.virginia.gov/documents/StandardsandCriteria.pdf.

Many faculty members from the Crop and Soil Environmental Sciences, Forestry, and Horticulture Departments served as resource personnel for the various cropping areas and assisted in preparing materials for this publication. The following is a list of those contributors.

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COMPUTER CROP CODE NUMBERS

Commercial Crop Production

Field

1. Corn (Grain), No Till
2. Corn (Grain), Conventional
3. Corn (Silage), No Till
4. Corn (Silage), Conventional
5. Sorghum (Grain)
6. Wheat
7. Barley
8. Oats
9. Rye (Grain or Silage Only)
10. Soybeans
11. Sm Gr - Soybean Double Crop Rotation
12. Sm Gr - Gr Sor Double Crop Rotation
13. Peanuts
14. Cotton
15. Tobacco, Flue-Cured
16. Tobacco, Dark-Fired
17. Tobacco, Sun-Cured
18. Tobacco, Burley
19. Corn - Peanut Rotation
20. Irrigated Corn
21. Canola
22. Sorghum (Silage)
23. Barley Silage – Corn Silage Rotation

Forage Crops – Establishment

30. Alfalfa or Alfalfa with Grass
31. Tall Grass (Fescue/Orchardgrass) with or without Clover (Red/Ladino)
32. Wildlife/Erosion Control Mixture
34. Bermudagrass
35. Sorghum-Sudan, Millet, Sudan
36. Small Grains with Winter Annual Legumes for Hay or Grazing

Forage Crops - Maintenance

37. Alfalfa or Alfalfa with Grass for Hay
38. Tall Grass with Clover for Hay
40. Tall Grass with Clover for Pasture
42. Native or Unimproved Pasture
44. Tall Grass (Fescue/Orchardgrass) for Hay
45. Stockpiled Tall Fescue
46. Bermudagrass for Pasture
47. Bermudagrass for Hay
48. Switchgrass

Commercial Vegetable Crops

50. Asparagus - Nonhybrid Strains
51. Asparagus - New Hybrids
52. Beans, Lima
53. Beans, Snap
54. Broccoli, Cauliflower
55. Cabbage
56. Brussels Sprouts, Collards
57. Cucumbers
58. Muskmelons
59. Onions, Bulbs
60. Onions, Scallions
61. Peas
62. Peppers
63. Potatoes, White
64. Potatoes, Sweet
65. Pumpkins
66. Spinach
67. Squash
69. Sweet Corn - Fresh Market
70. Sweet Corn - Processing
71. Tomatoes - Fresh Market, Bare Ground
76. Tomatoes - Fresh Market, Poly Mulch
72. Tomatoes - Process, Multiple Harvests
73. Tomatoes - Process, Single Harvest
74. Watermelons

Commercial Sod Production

90. Kentucky Bluegrass, Fescue
91. Bermuda, Zoysia

Fruit Crops

94. Grapes
95. Apples
96. Peaches
97. Strawberries
98. Blueberries
99. Blackberries, Raspberries

Specialty Crops

171. Hemp for Fiber
172. Hemp for Seed
173. Hemp for Flower
175. Hops

Commercial Forest Tree Crops

- | | |
|-------------------------------------|--|
| 105. Hardwood Establishment | 113. Christmas Trees - Fraser Fir,
Norway Spruce, Hemlock |
| 106. Hardwood Maintenance | 114. Christmas Trees - White Pine,
Virginia Pine, Scotch Pine |
| 107. Hardwood Nursery, Black Walnut | 115. Christmas Trees - Blue Spruce,
Red Cedar |
| 109. Pine Establishment | 116. Christmas Trees - Nursery |
| 110. Pine Maintenance | |
| 111. Pine Nursery | |

Golf Courses and Industrial Lawns

- | | |
|--|-------------------------------------|
| 80. Putting Greens, Bentgrass | 81. Putting Greens, Bermudagrass |
| 82. Tees, Bentgrass | 83. Tees, Bermudagrass |
| 84. Fairways - Bluegrass, Fescue | 85. Fairways - Bermudagrass |
| 86. Athletic Fields - Bluegrass, Fescue | 87. Athletic Fields - Bermudagrass |
| 88. Industrial Lawns - Bluegrass, Fescue | 89. Industrial Lawns - Bermudagrass |

Home Lawns, Gardens, Fruits, and Ornamentals

Lawn - Kentucky Bluegrass, Fescue, or Ryegrass

- 201. New Lawn Establishment
- 202. Lawn Maintenance

Lawn – Bermudagrass, Zoysiagrass, or St. Augustine

- 203. New Lawn Establishment
- 204. Lawn Maintenance

Garden

- 210. Vegetable Garden
- 211. Flower Garden
- 212. Roses

Fruits

- 220. Apples
- 221. Blackberries
- 222. Blueberries
- 223. Currants
- 224. Gooseberries
- 225. Grapes

- 226. Nectarines
- 227. Peaches
- 228. Pears
- 229. Plums
- 230. Quince
- 231. Raspberries
- 232. Sour Cherry
- 233. Strawberries
- 234. Sweet Cherry

Shrubs & Trees

- 240. Azaleas
- 241. Andromedas
- 242. Camellias
- 243. Laurel
- 244. Rhododendron
- 245. Shrubs, Non Acid-Loving
- 246. Trees

Other Plant Species

- 250. Potted House Plants

Commercial Greenhouse and Nursery Production

Cut Flowers

- 301. Carnations
- 302. Chrysanthemums (Cut Flowers)
- 303. Snapdragons

Pot Plants

- 310. Azaleas
- 311. Chrysanthemums (Pot Plants)
- 312. Lilies
- 313. Poinsettias

Other Plants

- 320. Bedding Plants
- 321. Foliage Plants
- 322. Hanging Baskets
- 323. Vegetable Transplants

Nursery Production

- 351. Field Grown - Acid-Loving Plants
- 352. Field Grown - Non Acid-Loving
- 353. Container Grown - Acid-Loving
- 354. Container Grown - Non Acid-Lov

Surface Mined Areas

Field Crops

- 401. Corn (Grain), No Till
- 402. Corn (Grain), Conventional
- 403. Corn (Silage), No Till
- 404. Corn (Silage), Conventional
- 405. Grain Sorghum
- 406. Wheat
- 407. Barley
- 408. Oats
- 409. Rye (Grain or Silage Only)
- 410. Soybeans
- 411. Sm Gr - Soy Double Crop Rot
- 412. Sm Gr - Gr Sor Double Crop Rot

Grass&Legume - Establishment

- 420. Erosion Control Mixtures
- 421. Hay and Pasture Mixtures
- 422. Critical Areas Mixtures
- 423. Temporary Cover Mixtures

Forage Production - Maintenance

- 437. Alfalfa, Alfalfa - Grass Hay
- 438. Red Clover-Grass Hay

- 440. Tall Grass - Clover Pasture
- 444. Tall Grass - Hay
- 445. Stockpiled Tall Fescue

Commercial Vegetable Crops

- 457. Cucumbers
- 458. Muskmelons
- 462. Peppers
- 463. Potatoes, White
- 464. Potatoes, Sweet
- 465. Pumpkins
- 467. Squash
- 469. Sweet Corn - Fresh Market
- 471. Tomatoes - Fresh Market, Bare Grnd

Other Crops

- 488. Industrial Lawns
- 495. Apples
- 496. Peaches
- 497. Strawberries

EXTENSION UNIT CODE LIST

CODE	UNIT	CODE	UNIT	CODE	UNIT
001	Accomack	093	Isle of Wight	191	Washington
003	Albemarle	095	James City	193	Westmorelan
005	Alleghany	097	King and Queen	195	Wise
007	Amelia	099	King George	197	Wythe
009	Amherst	101	King William	199	York
011	Appomattox	103	Lancaster		
013	Arlington	105	Lee	<u>City of:</u>	
015	Augusta	107	Loudoun	510	Alexandria
017	Bath	109	Louisa	550	Chesapeake
019	Bedford	111	Lunenburg	590	Danville
021	Bland	113	Madison	650	Hampton
023	Botetourt	115	Mathews	680	Lynchburg
025	Brunswick	117	Mecklenburg	700	Newport News
027	Buchanan	119	Middlesex	710	Norfolk
029	Buckingham	121	Montgomery	730	Petersburg
031	Campbell	125	Nelson	740	Portsmouth
033	Caroline	127	New Kent	760	Richmond
035	Carroll	131	Northampton	800	Suffolk
036	Charles City	133	Northumberland	810	Virginia Beach
037	Charlotte	135	Nottoway		
041	Chesterfield	137	Orange		
043	Clarke	139	Page	<u>Agricultural Research & Extension</u>	
045	Craig	141	Patrick	<u>Centers:</u>	
047	Culpeper	143	Pittsylvania	911	Virginia Tech Campus
049	Cumberland	145	Powhatan	912	Southern Piedmont
051	Dickenson	147	Prince Edward	913	Tidewater
053	Dinwiddie	149	Prince George	914	Eastern Virginia
057	Essex	153	Prince William	915	Northern Piedmont
059	Fairfax	155	Pulaski	921	Shenandoah Valley
061	Fauquier	157	Rappahannock	922	Southwest Virginia
063	Floyd	159	Richmond	924	VCIA Foundation Seed Farm
065	Fluvanna	161	Roanoke	925	Hampton Roads
067	Franklin	163	Rockbridge	931	Eastern Shore
069	Frederick	165	Rockingham		
071	Giles	167	Russell		
073	Gloucester	169	Scott		
075	Goochland	171	Shenandoah		
077	Grayson	173	Smyth		
079	Green	175	Southampton		
081	Greensville	177	Spotsylvania		
083	Halifax	179	Stafford		
085	Hanover	181	Surry		
087	Henrico	183	Sussex		
089	Henry	185	Tazewell		
091	Highland	187	Warren		

TESTS OFFERED BY THE SOIL TESTING LABORATORY, METHODS USED, AND SOIL TEST CALIBRATIONS

Tests Offered

The procedures used in the Soil Testing Laboratory were established in the early 1950's (Rich, C. I. 1955. Rapid soil testing procedures used at Virginia Polytechnic Institute. Virginia Agr. Exp. Sta. Bull 475, 8 p.). Although the basic chemical principles have not changed, procedures have been revised in recent years to utilize advances in instrumentation which allow more accurate and rapid chemical determinations. Test procedures currently used for the various analyses are presented in Publication 452-881, *Laboratory Procedures: Virginia Tech Soil Testing Laboratory*, at www.soiltest.vt.edu.

In the testing program, a routine test consisting of 10 separate analyses is performed on all samples. In addition, 2 special tests are offered on a request basis. These tests are applicable only under certain conditions for which research and calibration work have been conducted. The routine and special tests consist of the following:

Routine Tests

soil (water) pH
buffer (pH) index
phosphorus (P)
potassium (K)
calcium (Ca)
magnesium (Mg)
zinc (Zn)
manganese (Mn)
copper (Cu)
iron (Fe)
boron (B)
aluminum (Al) {reported on research samples only}

Special Tests

organic matter
soluble salts

Extensive research has been and continues to be conducted for those essential plant elements for which soil tests are not presently offered. Calibration of the various soil tests offered by the laboratory, where this information is available, as well as critical soil test levels for each of the tests, are presented on the following pages.

**Phosphorus (P), Potassium (K), Calcium (Ca), and Magnesium (Mg)
Soil Test Calibration**

<u>Ext. P</u>	<u>P - lb/A</u>	<u>P - ppm</u>	<u>P₂O₅ - lb/A</u>
L-	0-3	0-2	0-7
L	4-8	2-4	9-18
L+	9-11	5-6	21-25
M-	12-20	6-10	28-46
M	21-30	11-15	48-69
M+	31-35	16-18	71-80
H-	36-55	18-28	82-126
H	56-85	28-43	128-195
H+	86-110	43-55	197-252
VH	110+	55+	252+

<u>Ext. K</u>	<u>K - lb/A</u>	<u>K - ppm</u>	<u>K₂O - lb/A</u>
L-	0-15	0-8	0-18
L	16-55	8-28	19-66
L+	56-75	28-38	68-90
M-	76-100	38-50	92-121
M	101-150	51-75	122-181
M+	151-175	76-88	182-211
H-	176-210	88-105	212-253
H	211-280	106-140	254-337
H+	281-310	141-155	339-373
VH	310+	155+	373+

<u>Ext. Ca</u>	<u>Ca - lb/A</u>	<u>Ca - ppm</u>	<u>CaO - lb/A</u>
L-	0-240	0-120	0-336
L	241-480	121-240	337-672
L+	481-720	241-360	673-1007
M-	721-960	361-480	1009-1343
M	961-1200	481-600	1344-1679
M+	1201-1440	601-720	1680-2015
H-	1441-1680	721-840	2016-2350
H	1681-1920	841-960	2352-2686
H+	1921-2160	961-1080	2688-3022
VH	2161-2400+	1081-1200+	3023-3358+

<u>Ext. Mg</u>	<u>Mg - lb/A</u>	<u>Mg - ppm</u>	<u>MgO - lb/A</u>
L-	0-24	0-12	0-40
L	25-48	13-24	42-80
L+	49-72	25-36	81-119
M-	73-96	37-48	121-159
M	97-120	49-60	161-199
M+	121-144	61-72	201-239
H-	145-168	73-84	240-279
H	169-192	85-96	280-318
H+	193-216	97-108	320-358
VH	217-240+	109-120+	360-398+

Zinc (Zn) Soil Test Calibration

The following equation describes the relationship between zinc, soil pH, and phosphorus in the soil and whether or not zinc fertilizer will be needed.

$$\text{Zinc Availability Index} = 780.2 + [68.8 \times \text{Zn (ppm)}] - [101.3 \times \text{pH}] - [0.2 \times \text{P (lb/A)}]$$

The critical zinc availability index, developed from research data on Virginia soils, is 135. Below 135, zinc fertilizer will be needed. The following table provides information on whether zinc will be recommended using the above equation.

Examples of Zinc Soil Test Calibration Using the Mehlich 1 Procedure				
Zinc Recommended	Zinc Availability Index	Zinc Soil Test (ppm)	Soil pH	P Soil Test (lb/A)
No	153	1.0	6.8	36†
No	146	0.9	6.8	36
No	139	0.8	6.8	36
Yes	132	0.7	6.8	36
Yes	125	0.6	6.8	36
Yes	119	0.5	6.8	36
No	193	0.7	6.2	36
No	186	0.6	6.2	36
No	179	0.5	6.2	36
No	173	0.4	6.2	36
No	166	0.3	6.2	36
No	159	0.2	6.2	36
No	322	0.8	5.0	36
No	271	0.8	5.5	36
No	221	0.8	6.0	36
No	170	0.8	6.5	36
No	160	0.8	6.6	36
No	150	0.8	6.7	36
No	140	0.8	6.8	36
Yes	130	0.8	6.9	36
Yes	119	0.8	7.0	36
No	145	0.8	6.8	6 (L)
No	141	0.8	6.8	26 (M)
No	137	0.8	6.8	46 (H)
Yes	124	0.8	6.8	112 (VH)

† Phosphorus soil test level of 36 lb/A is the separation point between Medium (M) and High (H).

Manganese (Mn) Soil Test Calibration

Manganese Calibration – Soybeans	
Soil Test Manganese ppm	Recommend Manganese If The Soil pH Is Equal To Or Greater Than The Following (0.22733 x Mn ppm) + 5.1
0.0 - 0.4	5.1
0.5 - 0.9	5.2
1.0 - 1.4	5.3
1.5 - 1.6	5.4
1.7 - 1.9	5.5
2.0 - 2.4	5.6
2.5 - 2.9	5.7
3.0 - 3.4	5.8
3.5 - 3.9	5.9
4.0 - 4.4	6.0
4.5 - 4.9	6.1
5.0 - 5.1	6.2
5.2 - 5.4	6.3
5.5 - 5.9	6.4
6.0 - 6.4	6.5
6.5 - 6.9	6.6
7.0 - 7.4	6.7
7.5 - 7.9	6.8
8.0 - 8.4	6.9
8.5 -	7.0

Manganese Calibration – Peanuts	
Soil Test Manganese ppm	Recommend Manganese If The Soil pH Is Equal To Or Greater Than The Following (0.1 x Mn ppm) + 5.8
0.0 - 0.9	5.8
1.0 - 1.9	5.9
2.0 - 2.9	6.0
3.0 - 3.9	6.1
4.0 - 4.9	6.2
5.0 - 5.9	6.3
6.0 - 6.9	6.4
7.0 - 7.9	6.5
8.0 - 8.9	6.6
9.0 - 9.9	6.7
10.0 - 10.9	6.8
11.0 - 11.9	6.9
12.0 - 12.9	7.0

Organic Matter (OM) Soil Test Calibration

Level	%
L	0.0 - 0.9
M	1.0 - 1.9
H	2.0 - 2.9
VH	>2.9

Soluble Salt (SS) Soil Test Calibration

Rating	Soil, Soil- Lightwt. Mixes	Soil- less Mixes	Greenhouse, Nursery Interpretation	Computer Comment No.
	———— ppm ————			
L	0-422	0-640	Low soluble salts indicate that fertilizer is needed.	671
M	423-844	641-1280	Soluble salts approaching optimum level.	672
H	845-1664	1281-2240	Soluble salts are in desirable range. No fertilizer is needed, but light applications can be made.	673
VH	1665-2240	2241-3200	Soluble salts are OK for established plants. For seedlings and cuttings, salts are approaching borderline - partial leaching is recommended.	674
VH	2241-2560	3201-3520	Soluble salts are OK for established plants. For seedlings and cuttings, salts are too high and should be leached.	675
EH	>2560	>3520	Soluble salts are in critical range. Leach media.	676
	———— Soil -- ppm --		———— Field Crop Interpretation	
	0-844		Soluble salts are not high enough to cause salt injury.	677
	>844		Soluble salts are high and may, under certain conditions, cause problems with plant growth. See your Extension Agent.	678

Critical Soil Test Levels

Soil Test	Critical Level†	Comments
pH	5.0 - 5.5	Non-leguminous agronomic crops. Critical level varies depending on Al content of soil.
	6.5 - 7.0	Legumes. While pH's below 6.5 will not necessarily cause stand failure, reduced growth and vigor for some legumes such as alfalfa will occur.
P	<12 lbs/A	<12 = L+, L, L- soil test categories.
K	<56 lbs/A	<56 = L, L- soil test categories. In loamy sands and deep sandy loams, K tends to move downward and accumulate in the subsoil. For these soils, an L or L- test of the plow layer does not necessarily indicate a problem since plant roots can reach the subsoil K.
Ca	<241 lbs/A	<241 = L- soil test category. At this level, Ca is not necessarily deficient for plant growth except for peanuts. However, the soil pH is normally too low for optimum growth. Either regular Ag lime, dolomitic or calcitic can be used to increase pH.
Mg	<25 lbs/A	<25 = L- soil test category and is the critical level for Coastal Plain Soils.
	<49 lbs/A	<49 = L-, L soil test categories and is the critical level for Piedmont and Appalachian soils. To correct problem, recommend dolomitic lime if pH is low. If pH is optimum, recommend 30 lbs Mg fertilizer/A.
Zn	Variable-- depending on soil pH	Applicable for corn, small grains and grain sorghum. The soil test Zn requirement has not been determined for other crops but would be expected to be rather low.
Mn	Variable-- depending on soil pH	See Soil Test Calibration. Applicable for soybeans and peanuts only.
SS	1000+ ppm	Critical level depends on crop, soil type, and soil moisture. For most crops under normal soil moisture conditions, salts have to be in excess of 1000 ppm before injury begins to occur.
OM	<1%	This level does not necessarily indicate that plant growth will be limited but points to the possibility of soil compaction and other soil physical problems.

†The critical levels above are valid only for Virginia Tech lab procedures.

FERTILIZER RECOMMENDATIONS - GENERAL

How Recommendations are Made

Although information on making fertilizer recommendations is presented in other sections of this publication, it was felt that a brief discussion on how the computer makes fertilizer recommendations would be pertinent.

The computer calculates fertilizer recommendations based on the following factors (inputs):

1. Crop to be grown
2. Previous crop
3. Previous crop's yield
4. Major soils in field
5. Field yield estimate
6. Soil test level for nutrients analyzed

The crop to be grown has its own individual nutrient requirements. The previous crop and previous crop's yield are used to determine if any allowance should be made for the amount of nitrogen contributed by this crop. Major soils in field or Field Yield Estimate are used to determine the productive potential of the soil so that recommendations can be adjusted accordingly. In the absence of this information, the computer will select the appropriate yield potential for that particular county or city. Lastly, soil test level indicates the amount of nutrients that the soil will be able to contribute to the crop. Manures are considered only insofar as whether or not a farmer requires information on the nutrients contributed by manures for adjustment of his own recommendation. This information is provided to him in the form of a Soil Test Note. This has the advantage that the fertilizer recommendation can be used whether or not the farmer decides to use manure; ie., it would not have to be adjusted later on if the farmer decided not to apply manure to that particular field.

Nitrogen (N) Allowance For Use of Legume in Rotation

If a legume was the previous crop in the rotation, an adjustment can be made in the recommendation for the amount of nitrogen contributed by the legume. The first step in making the adjustment is to determine the amount of nitrogen contributed by the particular legume under good growing conditions. The following table provides this information.

Previous Crop	N Supplied to Following Crop Under Good Growing Conditions lbs/A
Soybeans	1/2 lb N/bu
Peanuts (vines)	45
Alfalfa	90
Red Clover	80
Ladino Clover	60

The second step is to rate the actual yield of the previous crop; i.e., high, average, or low. Yields for the various legume crops and their ratings are found in the following table.

Crop†	Previous Yield Per Acre‡		
	High	Average	Low
Soybeans	>30 bu	25-30 bu	<25 bu
Peanuts	-	-	-
Alfalfa	>4 T	3-4 T	<3 T
Red Clover	>4 T	3-4 T	<3 T
Ladino Clover	-	-	-

†For hay or pasture where legumes are grown in combination with grass, the legume should make up >25% of the stand before an adjustment is made.

‡For alfalfa and red clover, "High" is equivalent to >50% stand, "Medium" = 25-50% stand, and "Low" = <25% stand.

The third step is to adjust the amount of N supplied by the legume crop according to the actual yields observed. The following table contains this information.

Previous Yield	N Allowance, %
High	100
Average	75
Low	50

Example: If the previous crop was red clover, a good crop would supply about 80 lbs of N per acre. Actual yield for the red clover was 3 tons per acre or an "average" rating. Calculations: 80 lbs of N per acre X 0.75 (75%) = 60 lbs of N supplied by the red clover. This value is subtracted from the basic N recommendations.

FERTILIZER RECOMMENDATIONS - N, P, K - BY CROP

Crop: Corn for Grain (No-Till or Conventional)

VALUES Crop Code: 1, 2, 401, 402

Target pH = 6.2

See Notes: 1, 2, (4, 5)

Possible Trace Element Need: Zn (see page 8)

Soil Productivity Groups I, II

Soil Test Level	Fertilizer Recommendations (lb/A)		
	N	P ₂ O ₅	K ₂ O
L	1 lb. of N/Bu of expected yield	100 - 140	100 - 140
M		60 - 100	60 - 100
H		20 - 60	20 - 60
VH		0	0

Soil Productivity Groups III, IV, V

Soil Test Level	Fertilizer Recommendations (lb/A)		
	N	P ₂ O ₅	K ₂ O
L	1 lb. of N/Bu of expected yield	80 - 120	80 - 120
M		40 - 80	40 - 80
H		20 - 40	20 - 40
VH		0	0

Comments to Accompany Recommendations:

 Situation: Corn - peanut rotation.

Comment **107:** Important--apply the total amount of N, P₂O₅, and K₂O recommended for corn and peanuts to the corn crop for best results.

 Situation: Corn - soybean rotation.

Comment **108:** The total amount of N, P₂O₅, & K₂O recommended for both corn and soybeans may be applied to the corn crop.

 Situation: Soil tests high or very high in P and/or K.

Comment **801:** The most effective method of application of low rates of phosphate and potash is in a starter (planter) fertilizer placed in a band 2 inches to one side and 2 inches below the seed. Total amount of nitrogen plus potash should not exceed 80 lbs/A.

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Situation: Standard Statement.

Comment **803**: Apply about 30-50 lb N/acre in a starter (planter) fertilizer and the remainder as a sidedress when the crop is about 18 inches tall.

Situation: Soil Management Group = BB, CC, DD, EE, FF, GG, HH, II, JJ, KK, LL, MM, NN, OO, PP or QQ, and these soils are $\geq 50\%$ of field.

Comment **804**: Based on soil map unit (SMU) information provided with sample, attempted production of corn on these soils is not recommended because of the low yield potential.

Crop: Corn for Silage (No-Till or Conventional)

VALUES Crop Code: 3, 4, 403, 404

Target pH = 6.2

See Notes: 1, 2, (4, 5)

Possible Trace Element Need: Zn (see page 8)

Soil Productivity Groups I, II

Soil Test Level	Fertilizer Recommendations (lb/A)		
	N	P ₂ O ₅	K ₂ O
L	1.1 lb. of N/Bu of expected yield	140 – 200	240 - 300
M		100 – 140	180 - 240
H		40 - 100	100 - 180
VH		0	0

Soil Productivity Groups III, IV, V

Soil Test Level	Fertilizer Recommendations (lb/A)		
	N	P ₂ O ₅	K ₂ O
L	1.1 lb. of N/Bu of expected yield	120 - 160	200 - 240
M		80 - 120	140 - 200
H		40 - 80	60 - 140
VH		0	0

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Comments to Accompany Recommendations for Corn Silage:

Situation:	Corn - peanut rotation.
Comment 107:	Important--apply the total amount of N, P ₂ O ₅ , and K ₂ O recommended for corn and peanuts to the corn crop for best results.

Situation:	Corn - soybean rotation.
Comment 108:	The total amount of N, P ₂ O ₅ , & K ₂ O recommended for both corn and soybeans may be applied to the corn crop.

Situation:	Soil tests high or very high in P and/or K.
Comment 801:	The most effective method of application of low rates of phosphate and potash is in a starter (planter) fertilizer placed in a band 2 inches to one side and 2 inches below the seed. Total amount of nitrogen plus potash should not exceed 80 lbs/A.

Situation:	Standard Statement.
Comment 803:	Apply about 30-50 lb N/acre in a starter (planter) fertilizer and the remainder as a sidedress when the crop is about 18 inches tall.

Situation:	Soil Management Group = BB, CC, DD, EE, FF, GG, HH, II, JJ, KK, LL, MM, NN, OO, PP or QQ, <u>and</u> these soils are $\geq 50\%$ of field.
Comment 804:	Based on soil map unit (SMU) information provided with sample, attempted production of corn on these soils is not recommended because of the low yield potential.

Crop: Grain Sorghum

VALUES Crop Code: 5, 405

Target pH = 6.2

See Notes: 1, 2, (4, 5)

Possible Trace Element Need: Zn (see page 8)

Soil Test Level	Fertilizer Recommendations (lb/A)		
	N	P ₂ O ₅	K ₂ O
L	1 lb. of N/Bu of expected yield	80 - 120	80 - 120
M		40 - 80	40 - 80
H		20 - 40	20 - 40
VH		0	0

Comments to Accompany Recommendations:

Situation: Grain sorghum - soybean rotation.

Comment **108:** The total amount of N, P₂O₅, & K₂O recommended for both grain sorghum and soybeans may be applied to the grain sorghum crop.

Situation: Soil tests high in P and/or K.

Comment **801:** The most effective method of application of low rates of phosphate and potash is in a starter (planter) fertilizer placed in a band 2 inches to one side and 2 inches below the seed. Total amount of nitrogen plus potash should not exceed 80 lbs/A.

Situation: Standard Statement.

Comment **803:** Apply about 30-50 lb N/acre in a starter (planter) fertilizer and the remainder as a sidedress when the crop is about 18 inches tall.

Situation: Soil Management Group = BB, CC, DD, EE, FF, GG, HH, II, JJ, KK, LL, MM, NN, OO, PP or QQ, and SMGs are ≥ 50% of field.

Comment **804:** Based on soil map unit (SMU) information provided with sample, attempted production of corn on these soils is not recommended because of the low yield potential.

Crop: Wheat, Barley

VALUES Crop Code: 6, 7, 406, 407

Target pH = 6.2

See Notes: 1, 2, (4, 5)

Possible Trace Element Need: Zn (see page 8), Mn and Cu (deficiencies have been documented, but there are no soil test calibrations for determining Mn and Cu deficiencies.)

Soil Test Level	Fertilizer Recommendations (lb/A)		
	N	P ₂ O ₅	K ₂ O
L	See Comment Below	80 - 120	80 - 120
M		40 - 80	40 - 80
H		20 - 40	20 - 40
VH		0	0

Comments to Accompany Recommendations:

Situation: N Recommendations.

Comment **810**: At Planting: apply 15-30 lbs N/A. If in-field nitrate test was run and NO₃⁻ in top 6" is greater than 30 ppm, then no N is needed.

December - January: if October - December rainfall was heavy, there are less than 3 tillers/plant, crop is pale green and there are several days in Jan-Feb with temperatures greater than 50°F, apply 30 lb N/A. Otherwise, apply no N.

February - early March, Single N Application: Count your tillers. If there are less than 100 tillers/sq. ft., apply 80 lb N/A. If there are more than 100 tillers/sq. ft., apply 30-40 lb N/A.

Situation: Soil Management Group = KK, LL, MM, NN, OO, PP and QQ, and these soils are ≥ 50% of field.

Comment **811**: These soils are not suited for production of small grains. Although recommendations have been provided, we would suggest that you consider another crop.

Situation: Coastal Plain county.

Comment **812**: These soils are highly leachable because of thick sandy surfaces. We suggest that you follow a February - early March Split N Application Program that requires a plant tissue test. In February, count your tillers. If there are less than 60 tillers/sq. ft., apply 60 lb N/A. For 60-100 tillers/sq. ft., apply 40 lb N/A. For greater than 100 tillers/sq. ft., apply no N. Then in March, tissue test and follow lab's recommendations.

Crop: Oats, Rye for Grain or Silage

VALUES Crop Code: 8, 9, 408, 409

Target pH = 6.2

See Notes: 1, 2, (4, 5)

Possible Trace Element Need: Zn (see page 8), Mn and Cu (deficiencies have been documented, but there are no soil test calibrations for determining Mn and Cu deficiencies.)

Soil Test Level	Fertilizer Recommendations (lb/A)		
	N	P ₂ O ₅	K ₂ O
L	See Comment Below	80 - 120	80 - 120
M		40 - 80	40 - 80
H		20 - 40	20 - 40
VH		0	0

Comments to Accompany Recommendations:

Situation: N Recommendations.
Comment **813:** At planting, apply 25-30 lb N/A. The following February, apply 45 lb N/A for grain production or 75 lb N/A for silage.

Crop: Soybeans

VALUES Crop Code: 10, 410

Target pH = 6.2

See Notes: 1, 2, 4

Possible Trace Element Need: Mn (see page 9) and Mo (when soil pH <5.8)

Soil Test Level	Fertilizer Recommendations (lb/A)		
	N	P ₂ O ₅	K ₂ O
L	0	80 - 120	80 - 120
M		40 - 80	40 - 80
H		20 - 40	20 - 40
VH		0	0

Situation: Coastal Plain county.
Comment **705:** On very sandy soils (sands, loamy sands) where the clay layer is more than 20 inches below the surface, apply 30 lbs of sulfur per acre. Note – on heavier soils (sandy loams, loams) or sands where the clay layer is less than 20 inches from the surface, no response to sulfur is expected.

Crop: Small Grain - Soybean Double Cropping Rotation

Crop Code: 11, 411

Target pH = 6.2

See Notes: 1, 2, (4, 5)

Possible Trace Element Need: Zn (see page 8), Mn (see page 9) and Mo (when soil pH <5.8)

Soil Test Level	Fertilizer Recommendations (lb/A)		
	N	P ₂ O ₅	K ₂ O
L	See Comment Below	160 - 240	160 - 240
M		80 - 160	80 - 160
H		40 - 80	40 - 80
VH		0	0

Comments to Accompany Recommendations:

Situation: Standard Statement.
Comment **102:** Fertilizer recommendations are for both crops. Apply P₂O₅ and K₂O to the small grain. For the small grain crop, see N recommendation below.

Situation: Coastal Plain county.
Comment **706:** On very sandy soils (sands, loamy sands) where the clay layer is more than 20 inches below the surface, apply 30 lbs of sulfur per acre to the soybean crop. The sulfur can be applied when the small grain crop is topdressed or just prior to planting the soybeans. NOTE - on heavier soils (sandy loams, loams) or sands where the clay layer is less than 20 inches from the surface, no response to sulfur is expected.

Situation: N Recommendations.
Comment **810:** At Planting: apply 15-30 lbs N/A. If in-field nitrate test was run and NO₃⁻ in top 6" is greater than 30 ppm, then no N is needed.

December - January: if October - December rainfall was heavy, there are less than 3 tillers/plant, crop is pale green and there are several days in Jan-Feb with temperatures greater than 50°F, apply 30 lb N/A. Otherwise, apply no N.

February - early March, Single N Application: Count your tillers. If there are less than 100 tillers/sq. ft., apply 80 lb N/A. If there are more than 100 tillers/sq. ft., apply 30-40 lb N/A.

Situation: Soil Management Group = KK, LL, MM, NN, OO, PP and QQ, and these soils are ≥ 50% of field.
Comment **811:** These soils are not suited for production of small grains. Although recommendations have been provided, we would suggest that you consider another crop.

See Wheat/Barley page for additional comment 812.

Crop: Small Grain - Grain Sorghum Double Cropping Rotation **VALUES Crop Code:** 12, 412

Target pH = 6.2

See Notes: 1, 2, (4, 5)

Possible Trace Element Need: Zn (see page 8), Mn (see page 9) and Cu (no soil test calibration)

Soil Test Level	Fertilizer Recommendations (lb/A)		
	N	P ₂ O ₅	K ₂ O
L	For Grain Sorghum: 1 lb. of N/Bu of expected yield	160 - 240	160 - 240
M		80 - 160	80 - 160
H		40 - 80	40 - 80
VH		0	0

Comments to Accompany Recommendations:

Situation: Standard Statement.

Comment **103:** P₂O₅ and K₂O recommendations are for both crops in the double-cropping rotation and should be applied to the small grain. The N recommendation in the table is for grain sorghum. For the small grain crop, see N recommendation below.

Situation: N Recommendations.

Comment **810:** At Planting: apply 15-30 lbs N/A. If in-field nitrate test was run and NO₃⁻ in top 6" is greater than 30 ppm, then no N is needed.

December - January: if October - December rainfall was heavy, there are less than 3 tillers/plant, crop is pale green and there are several days in Jan-Feb with temperatures greater than 50°F, apply 30 lb N/A. Otherwise, apply no N.

February - early March, Single N Application: Count your tillers. If there are less than 100 tillers/sq. ft., apply 80 lb N/A. If there are more than 100 tillers/sq. ft., apply 30-40 lb N/A.

Situation: Soil Management Group = KK, LL, MM, NN, OO, PP and QQ, and these soils are ≥ 50% of field.

Comment **811:** These soils are not suited for production of small grains. Although recommendations have been provided, we would suggest that you consider another crop.

See Wheat/Barley page for additional comment 812.

Crop: Peanuts

Crop Code: 13

Target pH = 6.2

See Notes: 1, 2, 4 (5)

Possible Trace Element Need: B (see Note 4) and Mn (see page 9)

Soil Test Level	Fertilizer Recommendations (lb/A)		
	N	P ₂ O ₅	K ₂ O
L	0	100 – 200	80 - 120
M		55 - 85	0
H		0 - 40	0
VH		0	0

Comments to Accompany Recommendations:

Situation: Coastal Plain county.

Comment **814:** Potassium can be lost through leaching. To insure an adequate supply for the peanut crop, apply that needed for the peanuts just before land preparation and plow it down.

Crop: Cotton

VALUES (via comment) **Crop Code:** 14

Target pH = 6.2

See Notes: 1, 2, 4 (5)

Possible Trace Element Need: B, S

Soil Test Level	Fertilizer Recommendations (lb/A)		
	N	P ₂ O ₅	K ₂ O
L	See Comment Below	80 - 120	80 - 120
M		40 - 80	40 - 80
H		20 - 40	20 - 40
VH		0	0

Comments to Accompany Recommendations:

Situation: Soil Management Group = P, Z, BB, CC, EE, FF, HH, JJ, KK, LL, MM, NN, OO, PP, QQ.

Comment **815**: Soils in this field are not suited for cotton production. If at all possible, select another field.

Situation: Standard Statement.

Comment **816**: N Recommendations: Apply 50 lbs N/bale of expected yield. To avoid possible stimulation of excessive vegetative growth and loss of unneeded nitrogen through leaching, apply only one-third of the planned nitrogen application rate at planting in a starter (planter) fertilizer. The remainder of the nitrogen should be applied at first square formation (about 45 days after planting). Reduce the planned nitrogen application by 10 lbs/A if following soybeans and by 20 lbs/A if following peanuts.

Situation: Soil Management Group = F, Q, S, T, DD, II.

Comment **817**: Nitrogen can be lost through leaching when rainfall in excess of the water holding capacity of the soil occurs within a period of 5 days or less. For 2" of excess water, add 1/3 more N. For 3"+ of excess water, add 1/2 to 3/4 more N. Note: do not add more N after the third week of blooming.

Situation: Standard Statement.

Comment **707**: Apply 20 lb/A of sulfur, except when following peanuts and then apply only 10 lb/A of sulfur.

Crop: Tobacco, Flue-Cured

Crop Code: 15

Target pH = 5.8

See Notes: 1, 6, (5)

Soil Test Level	Fertilizer Recommendations (lb/A)		
	N	P ₂ O ₅	K ₂ O
L	60 - 70	290 - 330	150 - 175
M		60 - 100	100 - 150
H		40	100
VH		40†	100†

†None recommended when Soil Test Level is > 600 lb/A.

Comments to Accompany Recommendations:

Situation: Standard Statement.

Comment **110:** The N recommendation is based on a topsoil depth of 12-18". If topsoil depth is less than 12", reduce the N rate by 10 lbs per acre; if the topsoil depth is greater than 18", increase the N rate by 10 lbs per acre.

Crop: Tobacco, Dark-Fired

Crop Code: 16

Target pH = 5.8

See Notes: 1, 7, (5)

Soil Test Level	Fertilizer Recommendations (lb/A)		
	N	P ₂ O ₅	K ₂ O
L	135	290 - 330	150 - 175
M		60 - 100	100 - 150
H		40	100
VH		40†	100†

†None recommended when Soil Test Level is > 600 lb/A.

Crop: Tobacco, Sun-Cured

Crop Code: 17

Target pH = 5.8

See Notes 1, 8, (5)

Soil Test Level	Fertilizer Recommendations (lb/A)		
	N	P ₂ O ₅	K ₂ O
L	110	290 - 330	150 - 175
M		60 - 100	100 - 150
H		40	100
VH		40†	100†

†None recommended when Soil Test Level is > 600 lb/A.

Crop: Tobacco, Burley

Crop Code: 18

Target pH = 6.2

See Notes 1, 9, (5)

Soil Test Level	Fertilizer Recommendations (lb/A)		
	N	P ₂ O ₅	K ₂ O
L	175	290 - 330	250 - 350
M		60 - 100	200 - 250
H		40	100 - 200
VH		40†	100†

†None recommended when Soil Test Level is > 600 lb/A.

Crop: Corn - Peanut Rotation

VALUES Crop Code: 19

Target pH = 6.2

See Notes: 1, 2, 4, (5)

Possible Trace Element Need: B (see Note 4), Zn (see page 8), and Mn (see page 9)

Soil Test Level	Fertilizer Recommendations (lb/A)		
	N	P ₂ O ₅	K ₂ O
L	1 lb. of N/Bu of expected Yield	180 - 320	160 - 240
M		95 - 165	40 - 80
H		20 - 80	20 - 40
VH		0	0

Comments to Accompany Recommendations:

Situation: Standard Statement.

Comment **107:** IMPORTANT--apply the total amount of N, P₂O₅, and K₂O recommended for corn and peanuts to the corn crop.

SEE CORN, PEANUTS SECTIONS FOR ADDITIONAL COMMENTS.

Crop: Irrigated Corn

Crop Code: 20

Target pH = 6.2

See Notes: 1, 2, (4, 5)

Possible Trace Element Need: Zn (see page 8)

Soil Test Level	Fertilizer Recommendations (lb/A)		
	N	P ₂ O ₅	K ₂ O
L	1 lb. of N/Bu of expected Yield	130 - 170	160 - 240
M		80 - 120	80 - 160
H		30 - 70	40 - 80
VH		0	0

Comments to Accompany Recommendations:

Situation: If soil is in a coastal plain county..

Comment **705:** On very sandy soils (sands, loamy sands) where the clay layer is more than 20 inches below the surface, apply 30 lbs of sulfur per acre. Note – on heavier soils (sandy loams, loams) or sands where the clay layer is less than 20 inches from the surface, no response to sulfur is expected.

Situation: Standard Statement.

Comment **803:** Apply about 30-50 lb N/acre in a starter (planter) fertilizer and the remainder as a sidedress when the crop is about 18 inches tall.

Crop: Canola

VALUES Crop Code: 21

Target pH = 6.2

See Notes: 1, 2, (4, 5)

Soil Test Level	Fertilizer Recommendations (lb/A)		
	N	P ₂ O ₅	K ₂ O
L	See Comment Below	80 - 120	80 - 120
M		40 - 80	40 - 80
H		20 - 40	20 - 40
VH		0	0

Comments to Accompany Recommendations:

Situation: Standard Statement

Comment **821:** N Recommendations: At planting, broadcast and disk in 30-40 lb N/A. In late February just before spring growth begins, apply 90-120 lb N/A. For highly leachable soils, split the spring N applications: in late February just before spring growth begins, apply 45-60 lb N/A. Four weeks later, apply a second 45-60 lb N/A.

Crop: Sorghum Silage

VALUES Crop Code: 22

Target pH = 6.2

See Notes: 1, 2, (4, 5)

Possible Trace Element Need: Zn (see page 8)

Soil Test Level	Fertilizer Recommendations (lb/A)		
	N	P ₂ O ₅	K ₂ O
L	80 - 140	80 - 120	80 - 120
M		40 - 80	40 - 80
H		20 - 40	20 - 40
VH		0	0

Comments to Accompany Recommendations:

Situation: Standard Statement.

Comment **803:** Apply about 30-50 lb N/acre in a starter (planter) fertilizer and the remainder as a sidedress when the crop is about 18 inches tall.

Crop: Barley Silage - Corn Silage Rotation

VALUES Crop Code: 23

Target pH = 6.2

See Notes: 1, 2, (4, 5)

Possible Trace Element Need: Zn (see page 8)

Soil Test Level	Fertilizer Recommendations (lb/A)		
	N	P ₂ O ₅	K ₂ O
L	1.1 lb. of N/Bu of expected corn silage yield	160 - 240	320 - 480
M		80 - 160	160 - 320
H		40 - 80	80 - 160
VH		0	0

Comments to Accompany Recommendations:

Situation: Standard Statement.

Comment **111**: P₂O₅ and K₂O recommendations are for both crops in the double-cropping rotation and should be applied to the barley. The N recommendation in the table is for corn. For the barley, see N recommendation below.

Situation: Standard Statement.

Comment **810**: AT PLANTING, apply 15-30 lb N/A. If in-field nitrate test was run and NO₃ in top 6 inches is greater than 30 ppm, no N is needed. FEBRUARY-EARLY MARCH, SINGLE N APPLICATION: Count your tillers. If there are less than 100 tillers per sq.ft., apply 80 lb N/A. If there are more than 100 tillers per sq.ft., apply 30-40 lb N/A.

Crop: Alfalfa or Alfalfa with Grass - Establishment

Crop Code: 30

Target pH = 6.8 with lime possibly recommended at pH of 6.7 or less

See Notes: 1, 3, (4, 5)

Possible Trace Element Need: B (if < 1.0 ppm) and Mo (if soil pH <5.8)

Soil Test Level	Fertilizer Recommendations (lb/A)		
	N	P ₂ O ₅	K ₂ O
L	0	150 - 170	150 - 170
M		120 - 140	120 - 140
H		50 - 110	50 - 110
VH		0	0

Comments to Accompany Recommendations:

Situation: Standard Statement.

Comment **121:** P₂O₅ and K₂O recommendations will supply the needed nutrients for establishment and one harvest year's growth.

Crop Code: 31

Crop: Tall Grass (Fescue/Orchardgrass) with or without Clover (Red/Ladino) - Establishment

Target pH = 6.2 with lime possibly recommended at pH of 6.1 or less

See Notes: 1, 3, (5)

Soil Test Level	Fertilizer Recommendations (lb/A)		
	N	P ₂ O ₅	K ₂ O
L	40	150 - 170	150 - 170
M		120 - 140	120 - 140
H		40 - 110	40 - 110
VH		0	0

Comments to Accompany Recommendations:

Situation: Standard Statement.

Comment **121:** P₂O₅ and K₂O recommendations will supply the needed nutrients for establishment and one harvest year's growth.

Situation: Standard Statement.

Comment **823:** Apply the nitrogen at the time the grass is seeded in late summer, early fall or early spring. Overseed the grass with clover the following February.

Crop: Wildlife/Erosion Control Mixture

Crop Code: 32

Target pH = 6.2 with lime possibly recommended at pH of 6.1 or less

See Notes: 1, 3, (5)

Soil Test Level	Fertilizer Recommendations (lb/A)		
	N	P ₂ O ₅	K ₂ O
L	50	75	75
M		50	50
H		0	0
VH		0	0

Comments to Accompany Recommendations:

Situation: if pH < 5.8

Comment **620**: For best results, the lime should be applied six months to one year ahead of time.

Crop: Bermudagrass - Establishment

Crop Code: 34

Target pH = 6.2 with lime possibly recommended at pH of 6.1 or less

See Notes: 1, 3, (5)

Soil Test Level	Fertilizer Recommendations (lb/A)		
	N	P ₂ O ₅	K ₂ O
L	70	100 - 120	100 - 120
M		70 - 90	70 - 90
H		40 - 60	40 - 60
VH		0	0

Comments to Accompany Recommendations:

Situation: Standard Statement.

Comment **121:** P₂O₅ and K₂O recommendations will supply the needed nutrients for establishment and one harvest year's growth.

Situation: Standard Statement.

Comment **128:** Apply another 40 to 60 lbs of N per acre after plants start spreading.

Crop: Sorghum - Sudan, Millet, Sudan – Establishment

Crop Code: 35

Target pH = 6.2 with lime possibly recommended at pH of 6.1 or less

See Notes: 1, 3, (5)

Soil Test Level	Fertilizer Recommendations (lb/A)		
	N	P ₂ O ₅	K ₂ O
L	70	100 - 120	100 - 120
M		70 - 90	70 - 90
H		40 - 60	40 - 60
VH		0	0

Comments to Accompany Recommendations:

Situation: Standard Statement.

Comment **129:** Apply the recommended N before seeding. After each cutting, apply 40 to 60 lbs of N per acre for maximum production.

Crop Code: 36

Crop: Small Grains with Winter Annual Legume for Hay or Grazing - Establishment

Target pH = 6.2 with lime possibly recommended at pH of 6.1 or less See Notes: 1, 3, (4, 5)

Possible Trace Element Need: Zn (see page 8)

Soil Test Level	Fertilizer Recommendations (lb/A)		
	N	P ₂ O ₅	K ₂ O
L	15 - <u>20</u>	60 - 80	60 - 80
M		40 - 60	40 - 60
H		10 - 40	10 - 40
VH		0	0

Comments to Accompany Recommendations:

Situation: Standard Statement.

Comment **130:** Apply the recommended N at seeding. If small grains are to be established alone (without a legume), topdress with 50 to 60 lbs of N per acre in late winter or early spring.

Crop: Alfalfa or Alfalfa with Grass for Hay - Maintenance

VALUES Crop Code: 37, 437

Target pH = 6.8

See Notes: 1, 3, (4, 5)

Possible Trace Element Need: B (if <1.0 ppm) and Mo (if soil pH <5.8)

Soil Productivity Group I

Soil Test Level	Fertilizer Recommendations (lb/A)		
	N	P ₂ O ₅	K ₂ O
L	0	100 - 120	390 - 450
M		70 - 90	300 - 360
H		40 - 60	40 - 210
VH		0	0

Soil Productivity Group II

Soil Test Level	Fertilizer Recommendations (lb/A)		
	N	P ₂ O ₅	K ₂ O
L	0	100 - 120	280 - 330
M		70 - 90	220 - 270
H		40 - 60	60 - 200
VH		0	0

Soil Productivity Group III

Soil Test Level	Fertilizer Recommendations (lb/A)		
	N	P ₂ O ₅	K ₂ O
L	0	70 - 90	200 - 240
M		40 - 60	160 - 185
H		40	40 - 145
VH		0	0

Comments to Accompany Recommendations:

Situation: K Recommendation greater than 200 lb/A.

Comment **824**: Split the application, applying half in the fall and half in the spring. If field sampled in spring, apply half in early spring and half after the first cutting.

VALUES Crop Code: 38, 438

Crop: Tall Grass with Clover (Red/Ladino) for Hay - Maintenance

Target pH = 6.2

See Notes: 1, 3, (5)

Soil Productivity Groups I, II

Soil Test Level	Fertilizer Recommendations (lb/A)		
	N	P ₂ O ₅	K ₂ O
L	0	100 - 120	200 - 240
M		70 - 90	160 - 185
H		40 - 60	40 - 145
VH		0	0

Soil Productivity Groups III, IV

Soil Test Level	Fertilizer Recommendations (lb/A)		
	N	P ₂ O ₅	K ₂ O
L	0	70 - 90	120 - 145
M		40 - 60	85 - 110
H		40 - 40	40 - 75
VH		0	0

Crop: Tall Grass (Fescue/Orchardgrass) with or without Clover for Pasture - Maintenance

Target pH = 6.2

See Notes: 1, 3, (5)

Soil Productivity Groups I, II

Soil Test Level	Fertilizer Recommendations (lb/A)		
	N	P ₂ O ₅	K ₂ O
L	See Comments Below	100 - 120	100 - 120
M		40 - 90	40 - 90
H		0	0
VH		0	0

Soil Productivity Groups III, IV

Soil Test Level	Fertilizer Recommendations (lb/A)		
	N	P ₂ O ₅	K ₂ O
L	See Comments Below	40 - 60	60 - 80
M		30 - 30	30 - 50
H		0	0
VH		0	0

Comments to Accompany Recommendations:

Situation: Standard Statement.

Comment **825**: If stand contains less than 25% clover, apply 40-60 lbs N/A.

Situation: Standard Statement.

Comment **131**: If additional production is needed later on, apply 40 to 60 lbs/A of N during the grazing season. If you are planning to overseed a legume into the stand, omit the N recommendation.

Situation: Standard Statement.

Comment **122**: P₂O₅ and K₂O recommendations are for annual application. However, rates can be doubled and applied every other year if desired.

Soil Productivity Groups I, II

Soil Test Level	Fertilizer Recommendations (lb/A)		
	N	P ₂ O ₅	K ₂ O
L	See Comments Below	150 - 200	150 - 200
M		75 - 125	75 - 125
H		0	0
VH		0	0

Soil Productivity Groups III, IV

Soil Test Level	Fertilizer Recommendations (lb/A)		
	N	P ₂ O ₅	K ₂ O
L	See Comments Below	100 - 120	100 - 120
M		40 - 90	40 - 90
H		0	0
VH		0	0

Comments to Accompany Recommendations:

Situation: Standard Statement.

Comment **825**: If stand contains less than 25% clover, apply 40-60 lbs N/A.

Situation: Standard Statement.

Comment **131**: If additional production is needed later on, apply 40 to 60 lbs/A of N during the grazing season. If you are planning to overseed a legume into the stand, omit the N recommendation.

Situation: Standard Statement.

Comment **123**: P₂O₅ and K₂O recommendations are for single applications made every 3 to 4 years. After this time, soils should be re-tested.

Crop: Tall Grass (Fescue/Orchardgrass) for Hay – Maintenance

VALUES Crop Code: 44, 444

Target pH = 6.2

See Notes: 1, 3, (5)

Soil Productivity Groups I, II

Soil Test Level	Fertilizer Recommendations (lb/A)		
	N	P ₂ O ₅	K ₂ O
L	80 - 100	100 - 120	200 - 240
M		70 - 90	160 - 185
H		40 - 60	40 - 145
VH		0	0

Soil Productivity Groups III, IV

Soil Test Level	Fertilizer Recommendations (lb/A)		
	N	P ₂ O ₅	K ₂ O
L	60 - 80	70 - 90	120 - 145
M		40 - 60	85 - 110
H		40 - 40	40 - 70
VH		0	0

Comments to Accompany Recommendations:

Situation: Soil Productivity Group = 1, 2

Comment **826:** The N recommendation is for a March application. If additional hay production is needed, apply 80 lbs N/acre after each cutting. Do not apply more than 250 lbs N/acre per year.

Situation: Soil Productivity Group = 3, 4

Comment **827:** The N recommendation is for a March application. For additional fall hay production, apply 60-80 lbs N/acre in late August/early September. Do not apply more than 160 lbs N/acre per year.

Crop: Stockpiled Tall Fescue - Maintenance

VALUES Crop Code: 45,445

Target pH = 6.2

See Notes: 1, 3, (5)

Soil Productivity Groups I, II

Soil Test Level	Fertilizer Recommendations (lb/A)		
	N	P ₂ O ₅	K ₂ O
L	See Comment Below	100 - 120	100 - 120
M		40 - 90	40 - 90
H		0	0
VH		0	0

Soil Productivity Groups III, IV

Soil Test Level	Fertilizer Recommendations (lb/A)		
	N	P ₂ O ₅	K ₂ O
L	See Comment Below	40 - 60	60 - 80
M		30	30 - 50
H		0	0
VH		0	0

Comments to Accompany Recommendations:

Situation: Soil Productivity Group = 1, 2

Comment **139**: N Recommendation: 50-90 lb/A. Apply the N in August. Where clover makes up more than 25% of the stand, use the 50 lb N rate. If clover is not present and you desire maximum production, apply the 90 lb N rate.

Situation: Soil Productivity Group = 3, 4

Comment **140**: N Recommendation: 40-60 lb/A. Apply the N in August. Where clover makes up more than 25% of the stand, use the 40 lb N rate. If clover is not present and you desire maximum production, apply the 60 lb N rate.

Crop: Bermudagrass for Pasture – Maintenance

VALUES Crop Code: 46

Target pH = 6.2

See Notes: 1, 3, (5)

All Soil Productivity Groups

Soil Test Level	Fertilizer Recommendations (lb/A)		
	N	P ₂ O ₅	K ₂ O
L	200	100 - 120	100 - 120
M		40 - 90	40 - 90
H		0	0
VH		0	0

Comments to Accompany Recommendations:

Situation: Standard Statement.

Comment **134:** The N recommendation represents the total amount of N to be applied during the season. Apply the N in at least 2-split applications, and preferably into a 3-way split of 100 lb in April, 50 lb in June, and 50 lb in August.

Crop: Bermudagrass for Hay – Maintenance

VALUES Crop Code: 47

Target pH = 6.2

See Notes: 1, 3, (5)

All Soil Productivity Groups

Soil Test Level	Fertilizer Recommendations (lb/A)		
	N	P ₂ O ₅	K ₂ O
L	See Comment Below	100 - 120	235 - 275
M		70 - 90	185 - 225
H		40 - 60	40 - 165
VH		0	0

Comments to Accompany Recommendations:

Situation: Standard Statement.

Comment **135:** Apply 240 to 300 lbs N/A in 3 equal split applications - early spring, after 1st cut, and after 2nd cut (but no later than early August). Do not apply more than 120 lbs/A of N per application.

Crop: Switchgrass

Crop Code: 48

Target pH = 5.8

See Notes: 1, 3, (5)

Soil Test Level	Fertilizer Recommendations (lb/A)		
	N	P ₂ O ₅	K ₂ O
L	See Comment Below	50	50
M		0	0
H		0	0
VH		0	0

Comments to Accompany Recommendations:

Situation: Standard Statement.

Comment 144: Do not apply N in year of establishment. However, if establishment has been successful over weeds, and forage is needed later during the establishment year, apply 30-40 lbs N/A in July. For MAINTENANCE YEARS, apply 50 lbs N/A in the spring and 50 lbs N/A right after first hay cutting (Late June - Early July).

Comment 145: If growing for a bio-fuel, then apply 50 lbs N/A only in the spring and harvest once a year at end of growing year (Oct-Nov), which will provide as much biomass as two cuttings. Allowing the grass to dry-out will recycle some nitrogen.

Crop: Asparagus - Nonhybrid Strains

Crop Code: 50

Target pH = 6.8

See Notes: 1, 4

Possible Trace Element Need: B

Soil Test Level	Fertilizer Recommendations (lb/A)		
	N	P ₂ O ₅	K ₂ O
L	50	150	200
M		100	150
H		50	100
VH		25†	50†

†None recommended when Soil Test Level is > 600 lbs/acre.

Situation: Standard Statement.

Comment **833**: For additional information refer to VCE Pub. #456-420, *Commercial Vegetable Production Recommendations*, www.pubs.ext.vt.edu/456/456-420/456-420.html

Crop: Asparagus - New Hybrids

Crop Code: 51

Target pH = 6.8

See Notes: 1, 4

Possible Trace Element Need: B

Soil Test Level	Fertilizer Recommendations (lb/A)		
	N	P ₂ O ₅	K ₂ O
L	75	200	300
M		150	225
H		100	150
VH		50†	75†

†None recommended when Soil Test Level is > 600 lbs/acre.

Situation: Standard Statement.

Comment **833**: For additional information refer to VCE Pub. #456-420, *Commercial Vegetable Production Recommendations*, www.pubs.ext.vt.edu/456/456-420/456-420.html

Crop: Beans, Lima

Crop Code: 52

Target pH = 6.2

See Notes: 1

Soil Test Level	Fertilizer Recommendations (lb/A)		
	N	P ₂ O ₅	K ₂ O
L	80	120	160
M		80	120
H		40	80
VH		20†	40†

†None recommended when Soil Test Level is > 600 lbs/acre.

Situation: Standard Statement.

Comment **833**: For additional information refer to VCE Pub. #456-420, *Commercial Vegetable Production Recommendations*, www.pubs.ext.vt.edu/456/456-420/456-420.html

Crop: Beans, Snap

Crop Code: 53

Target pH = 6.2

See Notes: 1

Soil Test Level	Fertilizer Recommendations (lb/A)		
	N	P ₂ O ₅	K ₂ O
L	40 - 80	80	80
M		60	60
H		40	40
VH		20†	20†

†None recommended when Soil Test Level is > 600 lbs/acre.

Situation: Standard Statement.

Comment **833**: For additional information refer to VCE Pub. #456-420, *Commercial Vegetable Production Recommendations*, www.pubs.ext.vt.edu/456/456-420/456-420.html

Crop: Broccoli, Cauliflower

Crop Code: 54

Target pH = 6.2

See Notes: 1, 4

Possible Trace Element Need: B and Mo

Soil Test Level	Fertilizer Recommendations (lb/A)		
	N	P ₂ O ₅	K ₂ O
L	150 - 200	200	200
M		100	100
H		50	50
VH		25†	25†

†None recommended when Soil Test Level is > 600 lbs/acre.

Situation: Standard Statement.

Comment **833**: For additional information refer to VCE Pub. #456-420, *Commercial Vegetable Production Recommendations*, www.pubs.ext.vt.edu/456/456-420/456-420.html

Crop: Cabbage

Crop Code: 55

Target pH = 6.2

See Notes: 1, 4

Possible Trace Element Need: B

Soil Test Level	Fertilizer Recommendations (lb/A)		
	N	P ₂ O ₅	K ₂ O
L	100 - 125	200	200
M		100	100
H		50	50
VH		25†	25†

†None recommended when Soil Test Level is > 600 lbs/acre.

Situation: Standard Statement.

Comment **833**: For additional information refer to VCE Pub. #456-420, *Commercial Vegetable Production Recommendations*, www.pubs.ext.vt.edu/456/456-420/456-420.html

Crop: Brussels Sprouts, Collards

Crop Code: 56

Target pH = 6.2

See Notes: 1, 4

Possible Trace Element Need: B

Soil Test Level	Fertilizer Recommendations (lb/A)		
	N	P ₂ O ₅	K ₂ O
L	75 - 125	150	150
M		100	100
H		50	50
VH		25†	25†

†None recommended when Soil Test Level is > 600 lbs/acre.

Situation: Standard Statement.

Comment **833**: For additional information refer to VCE Pub. #456-420, *Commercial Vegetable Production Recommendations*, www.pubs.ext.vt.edu/456/456-420/456-420.html

Crop: Cucumbers

Crop Code: 57, 457

Target pH = 6.2

See Notes: 1

Soil Test Level	Fertilizer Recommendations (lb/A)		
	N	P ₂ O ₅	K ₂ O
L	100 - 125	150	200
M		100	150
H		50	100
VH		25†	50†

†None recommended when Soil Test Level is > 600 lbs/acre.

Situation: Standard Statement.

Comment **833**: For additional information refer to VCE Pub. #456-420, *Commercial Vegetable Production Recommendations*, www.pubs.ext.vt.edu/456/456-420/456-420.html

Crop: Muskmelons

Crop Code: 58, 458

Target pH = 6.2

See Notes: 1, 4

Possible Trace Element Need: B

Soil Test Level	Fertilizer Recommendations (lb/A)		
	N	P ₂ O ₅	K ₂ O
L	75 - 100	150	200
M		100	150
H		50	100
VH		25†	50†

†None recommended when Soil Test Level is > 600 lbs/acre.

Situation: Standard Statement.

Comment **833**: For additional information refer to VCE Pub. #456-420, *Commercial Vegetable Production Recommendations*, www.pubs.ext.vt.edu/456/456-420/456-420.html

Crop: Onions, Bulbs

Crop Code: 59

Target pH = 6.2

See Notes: 1, 4

Possible Trace Element Need: B

Soil Test Level	Fertilizer Recommendations (lb/A)		
	N	P ₂ O ₅	K ₂ O
L	75 - 100	200	200
M		100	100
H		50	50
VH		25†	25†

†None recommended when Soil Test Level is > 600 lbs/acre.

Situation: Standard Statement.

Comment **833**: For additional information refer to VCE Pub. #456-420, *Commercial Vegetable Production Recommendations*, www.pubs.ext.vt.edu/456/456-420/456-420.html

Crop: Onions, Scallions (or Green)

Crop Code: 60

Target pH = 6.2

See Notes: 1, 4

Possible Trace Element Need: B

Soil Test Level	Fertilizer Recommendations (lb/A)		
	N	P ₂ O ₅	K ₂ O
L	150 - 200	200	200
M		100	100
H		50	50
VH		25†	25†

†None recommended when Soil Test Level is > 600 lbs/acre.

Situation: Standard Statement.

Comment **833**: For additional information refer to VCE Pub. #456-420, *Commercial Vegetable Production Recommendations*, www.pubs.ext.vt.edu/456/456-420/456-420.html

Crop: Peas

Crop Code: 61

Target pH = 6.2

See Notes: 1, 4

Possible Trace Element Need: B

Soil Test Level	Fertilizer Recommendations (lb/A)		
	N	P ₂ O ₅	K ₂ O
L	40 - 80	120	120
M		80	80
H		40	40
VH		20†	20†

†None recommended when Soil Test Level is > 600 lbs/acre.

Situation: Standard Statement.

Comment **833**: For additional information refer to VCE Pub. #456-420, *Commercial Vegetable Production Recommendations*, www.pubs.ext.vt.edu/456/456-420/456-420.html

Crop: Peppers

Crop Code: 62, 462

Target pH = 6.2

See Notes: 1, 4

Possible Trace Element Need: B

Soil Test Level	Fertilizer Recommendations (lb/A)		
	N	P ₂ O ₅	K ₂ O
L	100 - 130	200	200
M		150	150
H		100	100
VH		50†	50†

†None recommended when Soil Test Level is > 600 lbs/acre.

Situation: Standard Statement.

Comment 833: For additional information refer to VCE Pub. #456-420, *Commercial Vegetable Production Recommendations*, www.pubs.ext.vt.edu/456/456-420/456-420.html

Crop: Potatoes, White

Crop Code: 63, 463

Target pH = 5.2

See Notes: 1, 4

Possible Trace Element Need: B

Soil Test Level	Fertilizer Recommendations (lb/A)		
	N	P ₂ O ₅	K ₂ O
L	125 - 150	200	300
M		150	200
H		100	100
VH		50†	50†

†None recommended when Soil Test Level is > 600 lbs/acre.

Situation: Standard Statement.

Comment 833: For additional information refer to VCE Pub. #456-420, *Commercial Vegetable Production Recommendations*, www.pubs.ext.vt.edu/456/456-420/456-420.html

Crop: Potatoes, Sweet

Crop Code: 64, 464

Target pH = 5.2

See Notes: 1, 4

Possible Trace Element Need: B

Soil Test Level	Fertilizer Recommendations (lb/A)		
	N	P ₂ O ₅	K ₂ O
L	50 - 75	200	300
M		100	200
H		50	100
VH		25†	50†

†None recommended when Soil Test Level is > 600 lbs/acre.

Situation: Standard Statement.

Comment **833**: For additional information refer to VCE Pub. #456-420, *Commercial Vegetable Production Recommendations*, www.pubs.ext.vt.edu/456/456-420/456-420.html

Crop: Pumpkins

Crop Code: 65, 465

Target pH = 6.2

See Notes: 1

Soil Test Level	Fertilizer Recommendations (lb/A)		
	N	P ₂ O ₅	K ₂ O
L	50 - 75	150	200
M		100	150
H		50	100
VH		25†	50†

†None recommended when Soil Test Level is > 600 lbs/acre.

Situation: Standard Statement.

Comment **833**: For additional information refer to VCE Pub. #456-420, *Commercial Vegetable Production Recommendations*, www.pubs.ext.vt.edu/456/456-420/456-420.html

Crop: Spinach

Crop Code: 66

Target pH = 6.2

See Notes: 1

Soil Test Level	Fertilizer Recommendations (lb/A)		
	N	P ₂ O ₅	K ₂ O
L	100 - 125	200	200
M		150	150
H		100	100
VH		50†	50†

†None recommended when Soil Test Level is > 600 lbs/acre.

Situation: Standard Statement.

Comment 833: For additional information refer to VCE Pub. #456-420, *Commercial Vegetable Production Recommendations*, www.pubs.ext.vt.edu/456/456-420/456-420.html

Crop: Summer Squash

Crop Code: 67, 467

Target pH = 6.2

See Notes: 1

Soil Test Level	Fertilizer Recommendations (lb/A)		
	N	P ₂ O ₅	K ₂ O
L	75 - 100	150	200
M		100	150
H		50	100
VH		25†	50†

†None recommended when Soil Test Level is > 600 lbs/acre.

Situation: Standard Statement.

Comment 833: For additional information refer to VCE Pub. #456-420, *Commercial Vegetable Production Recommendations*, www.pubs.ext.vt.edu/456/456-420/456-420.html

Crop: Sweet Corn - Fresh Market

Crop Code: 69, 469

Target pH = 6.2

See Notes: 1, (4)

Soil Test Level	Fertilizer Recommendations (lb/A)		
	N	P ₂ O ₅	K ₂ O
L	125-150	160	160
M		120	120
H		80	80
VH		40†	40†

†None recommended when Soil Test Level is > 600 lbs/acre.

Situation: Standard Statement.

Comment **833**: For additional information refer to VCE Pub. #456-420, *Commercial Vegetable Production Recommendations*, www.pubs.ext.vt.edu/456/456-420/456-420.html

Crop: Sweet Corn – Processing

Crop Code: 70

Target pH = 6.2

See Notes: 1, (4)

Soil Test Level	Fertilizer Recommendations (lb/A)		
	N	P ₂ O ₅	K ₂ O
L	125 - 175	120	120
M		80	80
H		40	40
VH		20†	20†

†None recommended when Soil Test Level is > 600 lbs/acre.

Situation: Standard Statement.

Comment **833**: For additional information refer to VCE Pub. #456-420, *Commercial Vegetable Production Recommendations*, www.pubs.ext.vt.edu/456/456-420/456-420.html

Crop: Tomatoes - Fresh Market, Bare Ground

Crop Code: 71, 471

Target pH = 6.5

See Notes: 1, 4

Possible Trace Element Need: B

Soil Test Level	Fertilizer Recommendations (lb/A)		
	N	P ₂ O ₅	K ₂ O
L	90	200	300
M		150	200
H		100	100
VH		50†	50†

†None recommended when Soil Test Level is > 600 lbs/acre.

Situation: Standard Statement.

Comment **833:** For additional information refer to VCE Pub. #456-420, *Commercial Vegetable Production Recommendations*, www.pubs.ext.vt.edu/456/456-420/456-420.html

Crop: Tomatoes - Processing, Multiple Machine Harvests

Crop Code: 72

Target pH = 6.5

See Notes: 1, 4

Possible Trace Element Need: B

Soil Test Level	Fertilizer Recommendations (lb/A)		
	N	P ₂ O ₅	K ₂ O
L	100 - 130	250	300
M		150	200
H		100	100
VH		50†	50†

†None recommended when Soil Test Level is > 600 lbs/acre.

Situation: Standard Statement.

Comment **833:** For additional information refer to VCE Pub. #456-420, *Commercial Vegetable Production Recommendations*, www.pubs.ext.vt.edu/456/456-420/456-420.html

Crop: Tomatoes - Processing, Single Machine Harvest

Crop Code: 73

Target pH = 6.5

See Notes: 1, 4

Possible Trace Element Need: B

Soil Test Level	Fertilizer Recommendations (lb/A)		
	N	P ₂ O ₅	K ₂ O
L	75	200	250
M		150	150
H		100	100
VH		50†	50†

†None recommended when Soil Test Level is > 600 lbs/acre.

Situation: Standard Statement.

Comment **833**: For additional information refer to VCE Pub. #456-420, *Commercial Vegetable Production Recommendations*, www.pubs.ext.vt.edu/456/456-420/456-420.html

Crop: Watermelons – Non-irrigated

Crop Code: 74

Target pH = 6.2

See Notes: 1

Soil Test Level	Fertilizer Recommendations (lb/A)		
	N	P ₂ O ₅	K ₂ O
L	80 - 100	150	200
M		100	150
H		50	100
VH		25†	50†

†None recommended when Soil Test Level is > 600 lbs/acre.

Situation: Standard Statement.

Comment **833**: For additional information refer to VCE Pub. #456-420, *Commercial Vegetable Production Recommendations*, www.pubs.ext.vt.edu/456/456-420/456-420.html

Crop: Tomatoes - Fresh Market, Polyethylene Mulched

Crop Code: 76

Target pH = 6.5

See Notes: 1, 4

Possible Trace Element Need: B

Soil Test Level	Fertilizer Recommendations (lb/A)		
	N	P ₂ O ₅	K ₂ O
L	210	200	300
M		150	200
H		100	100
VH		50†	50†

Comments to Accompany Recommendations:

Situation: Standard Statement.

Comment **833**: For additional information refer to VCE Pub. #456-420, *Commercial Vegetable Production Recommendations*, www.pubs.ext.vt.edu/456/456-420/456-420.html

Crop: Putting Greens, Bentgrass; Tees, Bentgrass

Crop Code: 80, 82

Target pH = 6.5 with no lime recommended until soil pH is 6.2 or less

See Notes: 1, 15

Fertilizer Recommendations

Soil Test Level	P ₂ O ₅		K ₂ O	
	lbs/1000 sq. ft.	Time To Apply	lbs/1000 sq. ft.	Time To Apply
L	3	Aug To Dec	2 2	Aug to Dec Mar To June
M	2 - 2.5	Aug To Dec	1.5 - 2 1.5	Aug to Dec Mar To June
H	0 - 1.5	Aug To Dec	1 - 1.5 1	Aug to Dec Mar To June
VH	0 - 1	Aug To Dec	0 - 1 0 - 1	Aug to Dec Mar To June

Comments to Accompany Recommendations:

Situation: Standard Statement.

Comment **161:** For N recommendation, see related note listed in the Notes box in the upper right of this report.

Crop: Putting Greens, Bermudagrass; Tees, Bermudagrass

Crop Code: 81, 83

Target pH = 6.5 with no lime recommended until soil pH is 6.2 or less

See Notes: 1, 15

Fertilizer Recommendations

Soil Test Level	P ₂ O ₅		K ₂ O	
	lbs/1000 sq. ft.	Time To Apply	lbs/1000 sq. ft.	Time To Apply
L	3	Aug To Oct	2 2	Aug to Oct Mar To June
M	2 - 2.5	Aug To Oct	1.5 - 2 1.5	Aug to Oct Mar To June
H	0 - 1.5	Aug To Oct	1 - 1.5 1	Aug to Oct Mar To June
VH	0 - 1	Aug To Oct	0 - 1 0 - 1	Aug to Oct Mar To June

Comments to Accompany Recommendations:

Situation: Standard Statement.

Comment **161**: For N recommendation, see related note listed in the Notes box in the upper right of this report.

Crop: Fairways - Kentucky Bluegrass, Fescue, Bermudagrass;
 Athletic Fields - Kentucky Bluegrass, Fescue, Bermudagrass;
 Industrial Lawns - Kentucky Bluegrass, Fescue, Bermudagrass.

Target pH = 6.5 with no lime recommended until soil pH is 6.2 or less See Notes: 1, 14

Soil Test Level	Fertilizer Recommendations (lb/A)		
	N	P ₂ O ₅	K ₂ O
L	See Comment Below	80 - 120	80 - 120
M		60 - 80	60 - 80
H		40 - 60	40 - 60
VH		0	0

Comments to Accompany Recommendations:

Situation: Standard Statement.

Comment **161:** For N recommendations see Note.

Situation: Crop = 84, 85, 88, 89 or 488 and soil test P = Low and Soil test K = Low.

Comment **162:** The preferred time for P₂O₅ and K₂O application is late summer or fall. However, because of the large amounts needed, apply 1/2 of the P₂O₅ and K₂O in late summer and the remaining half 30 to 60 days later. Do not apply more than 80 lbs of K₂O in one application.

Situation: Crop = 84, 85, 88, 89 or 488 and soil test P = Low.

Comment **163:** The preferred time for P₂O₅ and K₂O application is late summer or fall. However, because of the large amount of P₂O₅ needed, apply 1/2 in late summer and the remaining half 30 to 60 days later.

Situation: Crop = 84, 85, 88, 89 or 488 and soil test K = Low.

Comment **164:** The preferred time for P₂O₅ and K₂O application is late summer or fall. However, because of the large amount of K₂O needed, apply 1/2 in late summer and the remaining half 30 to 60 days later. Do not apply more than 80 lbs of K₂O in one application.

Situation: Crop = 84, 85, 88, 89 or 488.

Comment **165:** The preferred time for P₂O₅ and K₂O application is late summer or early fall. May be applied in single or multiple application.

(Continued on next page.)

Situation: Crop = 86 and soil test P = Low and soil test K = Low.

Comment 166: The preferred time for P₂O₅ and K₂O application is August. However, because of the large amounts needed, apply 1/2 of the P₂O₅ and K₂O in August and 1/2 in December. Do not apply more than 80 of K₂O in one application.

Situation: Crop = 86 and soil test P = Low.

Comment 167: The preferred time for P₂O₅ and K₂O application is August. However, because of the large amount of P₂O₅ needed, apply 1/2 in August and 1/2 in December.

Situation: Crop = 86 and soil test K = Low.

Comment 168: The preferred time for P₂O₅ and K₂O application is August. However, because of the large amount of K₂O needed, apply 1/2 in August and 1/2 in December. Do not apply more than 80 lbs of K₂O in one application.

Situation: Crop = 86.

Comment 169: The preferred time for P₂O₅ and K₂O application is August. However, half of the fertilizer may be applied at this time and the remaining half applied during another season if so desired.

Situation: Crop = 87 and soil test P = Low and soil test K = Low.

Comment 170: The preferred time for P₂O₅ and K₂O application is August. However, because of the large amounts needed, apply 1/2 of the P₂O₅ and K₂O in August and 1/2 in early spring. Do not apply more than 80 lbs of K₂O in one application.

Situation: Crop = 87 and soil test P = Low.

Comment 171: The preferred time for P₂O₅ and K₂O application is August. However, because of the large amount of P₂O₅ needed, apply 1/2 in August and 1/2 in early spring.

Situation: Crop = 87 and soil test K = Low.

Comment 172: The preferred time for P₂O₅ and K₂O application is August. However, because of the large amount of K₂O needed, apply 1/2 in August and 1/2 in early spring. Do not apply more than 80 lbs. of K₂O in one application.

Situation: Crop = 87.

Comment 173: The preferred time for P₂O₅ and K₂O application is August. However, half of the fertilizer may be applied at this time and the remaining half applied during another season if it is so desired.

Crop Code: 90, 91

Crop: Sod Production - Kentucky Bluegrass, Fescue, Bermudagrass, Zoysiagrass

Target pH = 6.5 with no lime recommended until soil pH is 6.2 or less

See Notes: 1, 14

Soil Test Level	Fertilizer Recommendations (lb/A)		
	N	P ₂ O ₅	K ₂ O
L	See Comment Below	200 - 300	150 - 200
M		100 - 200	100 - 150
H		100	100
VH		0	0

Comments to Accompany Recommendations:

Situation: Standard Statement.

Comment **161:** For N recommendations see Note.

Situation: Crop = 90 - 91.

Comment **174:** Do not apply the above P₂O₅ and K₂O recommendations to established sod.

Crop: Grapes

Crop Code: 94

Target pH = 6.5

See Note: 1

Possible Trace Element Need: B (Bloom-time petiole sampling should be used to determine the vines' boron status.)

Soil Test Level	Fertilizer Recommendations (lb/A)		
	N	P ₂ O ₅	K ₂ O
L	See Comment Below	100	75
M		50	0
H		0	0
VH		0	0

Comments to Accompany Recommendations:

Situation: Standard Statement.

Comment **828**: There is no single index that serves well as a guide in assessing the vine's need for N fertilizer, and soil test results are rarely used for determining vine N needs. Instead, a combination of observed vine vigor, canopy condition, and plant tissue analysis results are used. Wine grapes rarely require more than 30 to 50 pounds of actual N per acre per year. Use lower rates for grafted vines and higher rates for non-grafted and/or heavily-cropped American-type grapevines. For additional information go to Viticulture Extension Resources web page at <https://www.arec.vaes.vt.edu/arec/olson-h-mith/grapes/viticulture/extension.html>

Crop: Apples

Crop Code: 95, 495

Target pH = 6.2

See Notes: 1, 10

Possible Trace Element Need: B (see Note 10)

Comments to Accompany Recommendations:

Situation: Standard Statement.

Comment **181:** FERTILIZER RECOMMENDATIONS: See Note 10.

Crop: Peaches

Crop Code: 96, 496

Target pH = 6.2

See Note: 1, 11

Comments to Accompany Recommendations:

Situation: Soil test P = Low and soil test K = Low.

Comment **182:** FERTILIZER RECOMMENDATIONS: N, P₂O₅, and K₂O fertilizer is needed for optimum peach production. For rates and times of fertilizer application, see Note 11.

Situation: Soil test P = Low and soil test K = Medium to Very High.

Comment **183:** FERTILIZER RECOMMENDATIONS: N and P₂O₅ fertilizer is needed for optimum peach production. For rates and times of fertilizer application, see Note 11.

Situation: Soil test P = Medium to Very High and soil test K = Low.

Comment **184:** FERTILIZER RECOMMENDATIONS: N and K₂O fertilizer is needed for optimum peach production. For rates and times of fertilizer application, see Note 11.

Situation: Soil test P = Medium to Very High and soil test K = Medium to Very High.

Comment **185:** FERTILIZER RECOMMENDATIONS: Nitrogen-only fertilizer is needed. For rates and times of fertilizer application, see Note 11.

Crop: Strawberries

Crop Code: 97, 497

Target pH = 6.2

See Note: 1

Soil Test Level	Fertilizer Recommendations (lb/A)		
	N	P ₂ O ₅	K ₂ O
L	See Comment Below	150	150
M		75	75
H		0	0
VH		0	0

Comments to Accompany Recommendations:

Situation: Standard Statement.

Comment 829: FOR PLASTICULTURE -- Broadcast 50-60 pounds of Nitrogen per Acre prior to bed shaping and planting. Apply an additional 50-60 pounds per acre from early March through harvest at 0.75 lb N/acre/day. Spring fertigation is best accompanied by plant tissue analysis to adjust the program to head off yield reductions associated with nutrient deficiencies.

Situation: Standard Statement.

Comment 832: FOR MATTED ROW CULTIVATION -- IF THE AGE OF A SPRING PLANTED FIELD IS LESS THAN 13 MONTHS, then apply the following amounts of nitrogen (N) in a 14 to 18 inch wide band. Two to three weeks after planting, apply 2.0 to 3.2 pounds of N per 1000 feet of bed. From early to mid-August, apply 3.2 to 4.8 lbs N per 1000 ft of bed. On very sandy sites only, from late February to early March, apply 1.3 to 1.6 lbs N per 1000 ft of bed. IF THE AGE OF A SPRING PLANTED FIELD IS MORE THAN 13 MONTHS, then apply the following amounts of nitrogen (N) in a 14 to 18 inch wide band. Immediately after harvest (during renovation), apply 3.2 to 5.6 pounds of N per 1000 feet of bed. On very sandy sites only, from early to mid-August, apply 3.2 to 6.4 lbs N per 1000 ft of bed. On very sandy sites only, from late February to early March, apply 1.3 to 1.6 lbs N per 1000 ft of bed.

Note: 1 lb N/1,000 ft of bed = 12.5 lbs actual N/Acre

Crop: Blueberries

Crop Code: 98

Target pH = 5.2

See Note: 1

Soil Test Level	Fertilizer Recommendations (lb/A)		
	N	P ₂ O ₅	K ₂ O
L	See Comment Below	150	150
M		75	75
H		0	0
VH		0	0

Comments to Accompany Recommendations:

Situation: Standard Statement.

Comment **830**: Apply a total 150 lb N/Acre of fertilized band in three applications beginning in early April (75 lb/A) with subsequent applications (37.5 lb/A + 37.5 lb/A) at 5 week intervals.

Crop: Blackberries, Raspberries

Crop Code: 99

Target pH = 6.2

See Note: 1

Soil Test Level	Fertilizer Recommendations (lb/A)		
	N	P ₂ O ₅	K ₂ O
L	See Comment Below	150	150
M		75	75
H		0	0
VH		0	0

Comments to Accompany Recommendations:

Situation: Standard Statement.

Comment **831**: Apply 185 lb N/Acre of fertilized band.

Note: Larger growers often broadcast the fertilizer out of convenience. Small growers often hand fertilize around the base of each plant. Ideally, N, P₂O₅ and K₂O should just be applied to a band 3 to 4 feet wide down the row area. Therefore, making the assumption that a grower wants to fertilize a 4 foot wide band and the between row spacing is 12 feet. That grower would be applying 1/3 of the total amount of fertilizer to that 4 foot wide strip. Another way it is done is to take the per acre rate and divide by the number of plants per acre and apply that amount per plant.

Crop: Hardwood Establishment

Crop Code: 105

Target pH = 5.2 with lime possibly recommended at pH of 5.1 or less

See Notes: 1, 12

Soil Test Level	Fertilizer Recommendations (lb/A)		
	N	P ₂ O ₅	K ₂ O
L	0	50 – 70	40 – 80
M		10 – 50	10 – 40
H		0	0
VH		0	0

Comments to Accompany Recommendations:

Situation: Standard Statement.

Comment **186:** See Note 12 for further information on fertilization and liming.

Crop: Hardwood Maintenance

Crop Code: 106

Target pH = 5.2

See Notes: 1, 12

Soil Test Level	Fertilizer Recommendations (lb/A)		
	N	P ₂ O ₅	K ₂ O
L	50 - 100	50 - 70	40 - 80
M		10 - 50	10 - 40
H		0	0
VH		0	0

Comments to Accompany Recommendations:

Situation: Standard Statement.

Comment **186:** See Note 12 for further information on fertilization and liming.

Crop: Hardwood Nursery, Black Walnut

Crop Code: 107

Target pH = 5.8

See Notes: 1, 12

Soil Test Level	Fertilizer Recommendations (lb/A)		
	N	P ₂ O ₅	K ₂ O
L	60 - 80	80 - 110	40 - 80
M		40 - 80	10 - 40
H		0	0
VH		0	0

Comments to Accompany Recommendations:

Situation: Standard Statement.

Comment **186:** See Note 12 for further information on fertilization and liming.

Crop: Pine Establishment

Crop Code: 109

Target pH = 5.2 with lime possibly recommended at pH of 5.1 or less

See Notes: 1, 12

Soil Test Level	Fertilizer Recommendations (lb/A)		
	N	P ₂ O ₅	K ₂ O
L	0	50 - 70	40 - 80
M		10 - 50	10 - 40
H		0	0
VH		0	0

Comments to Accompany Recommendations:

Situation: Standard Statement.

Comment **186:** See Note 12 for further information on fertilization and liming.

Crop: Pine Maintenance

Crop Code: 110

Target pH = 5.2

See Notes: 1, 12

Soil Test Level	Fertilizer Recommendations (lb/A)		
	N	P ₂ O ₅	K ₂ O
L	50 - 100	50 – 70	40 - 80
M		10 – 50	10 - 40
H		0	0
VH		0	0

Comments to Accompany Recommendations:

Situation: Standard Statement.

Comment **186:** See Note 12 for further information on fertilization and liming.

Crop: Pine Nursery

Crop Code: 111

Target pH = 5.2

See Notes: 1, 12

Soil Test Level	Fertilizer Recommendations (lb/A)		
	N	P ₂ O ₅	K ₂ O
L	60 - 80	80 - 110	40 - 80
M		40 - 80	10 - 40
H		0	0
VH		0	0

Comments to Accompany Recommendations:

Situation: Standard Statement.

Comment **186**: See Note 12 for further information on fertilization and liming.

Crop: Christmas Trees - Fraser Fir, Norway Spruce, Hemlock

Crop Code: 113

Target pH = 5.8

See Notes: 1, 23

Soil Test Level	Fertilizer Recommendations (lb/A)		
	N	P ₂ O ₅	K ₂ O
L	50	160 - 300	150 - 250
M		60 - 160	60 - 150
H		30 - 60	30 - 60
VH		0	0

Comments to Accompany Recommendations:

Situation: Standard Statement.

Comment **732**: The above recommendation is for broadcast application at establishment. To convert to a maintenance recommendation in ounces per tree, refer to the "Explanation of Fertilizer Rates" section in Soil Test Note 23.

Crop: Christmas Trees - White Pine, Virginia Pine, Scotch Pine

Crop Code: 114

Target pH = 5.2

See Notes: 1, 23

Soil Test Level	Fertilizer Recommendations (lb/A)		
	N	P ₂ O ₅	K ₂ O
L	50	90 - 150	100 - 160
M		40 - 90	50 - 100
H		30 - 40	30 - 50
VH		0	0

Comments to Accompany Recommendations:

Situation: Standard Statement.

Comment **732:** The above recommendation is for broadcast application at establishment. To convert to a maintenance recommendation in ounces per tree, refer to the "Explanation of Fertilizer Rates" section in Soil Test Note 23.

Crop: Christmas Trees - Blue Spruce, Red Cedar

Crop Code: 115

Target pH = 6.2

See Notes: 1, 23

Soil Test Level	Fertilizer Recommendations (lb/A)		
	N	P ₂ O ₅	K ₂ O
L	50	160 - 300	150 - 250
M		60 - 160	60 - 150
H		30 - 60	30 - 60
VH		0	0

Comments to Accompany Recommendations:

Situation: Standard Statement.

Comment **732**: The above recommendation is for broadcast application at establishment. To convert to a maintenance recommendation in ounces per tree, refer to the "Explanation of Fertilizer Rates" section in Soil Test Note 23.

Crop: Christmas Trees – Nursery

Crop Code: 116

Target pH = 5.2

See Notes: 1, 23

Soil Test Level	Fertilizer Recommendations (lb/1000 Sq. Ft.)		
	N	P ₂ O ₅	K ₂ O
L	See Comment Below	7 - 9	4 - 6
M		4 - 6	2 - 3
H		1 - 3	0 - 1
VH		0	0

Comments to Accompany Recommendations:

Situation: Standard Statement.

Comment **733:** Apply two and a half pounds of nitrogen per 1,000 sq. ft.

Crop: Hemp for Fiber

Crop Code: 171

Target pH = 6.5

See Note: 1

Soil Test Level	Fertilizer Recommendations (lb/A)		
	N	P ₂ O ₅	K ₂ O
L	See Comment Below	80 - 120	80 - 120
M		40 - 80	40 - 80
H		20 - 40	20 - 40
VH		0	0

Comments to Accompany Recommendations:

Situation: N Recommendations.

Comment 871: For fiber production, apply 60 to 100 lbs nitrogen per acre, depending on soil productivity. Consider split application with half at planting and the remainder applied 30 days afterward. Subtract any nitrogen credit for residual N from a previous legume crop or manure application. **THESE ARE PRELIMINARY RECOMMENDATIONS AND WILL BE UPDATED AS RESEARCH STUDIES PROGRESS.**

Crop: Hemp for Seed

Crop Code: 172

Target pH = 6.5

See Note: 1

Soil Test Level	Fertilizer Recommendations (lb/A)		
	N	P ₂ O ₅	K ₂ O
L	See Comment Below	80 - 120	80 - 120
M		40 - 80	40 - 80
H		20 - 40	20 - 40
VH		0	0

Comments to Accompany Recommendations:

Situation: N Recommendations.

Comment **872:** For seed/grain production, apply 100 to 150 lbs nitrogen per acre, depending on soil productivity. Consider split application with half at planting and the remainder applied 30 days afterward. Subtract any nitrogen credit for residual N from a previous legume crop or manure application. **THESE ARE PRELIMINARY RECOMMENDATIONS AND WILL BE UPDATED AS RESEARCH STUDIES PROGRESS.**

Crop: Hemp for Flower

Crop Code: 173

Target pH = 6.5

See Note: 1

Soil Test Level	Fertilizer Recommendations (lb/A)		
	N	P ₂ O ₅	K ₂ O
L	See Comment Below	80 - 120	80 - 120
M		40 - 80	40 - 80
H		20 - 40	20 - 40
VH		0	0

Comments to Accompany Recommendations:

Situation: N Recommendations.

Comment 873: For flower production, at planting apply 100 to 150 pounds of nitrogen per acre, depending on soil productivity. Do not apply any nitrogen after plants go to flower. Subtract any nitrogen credit for residual N from a previous legume crop or manure application. **THESE ARE PRELIMINARY RECOMMENDATIONS AND WILL BE UPDATED AS RESEARCH STUDIES PROGRESS.**

Crop: Hops

Crop Code: 175

Target pH = 6.2

See Notes: 1

Possible Trace Element Need: B (if < 1.5 ppm) and S

Soil Test Level	Fertilizer Recommendations (lb/A)		
	N	P ₂ O ₅	K ₂ O
L	See Comment Below	80 - 150	100 - 170
M		30 - 80	50 - 100
H		0 - 30	0 - 50
VH		0	0

Comments to Accompany Recommendations:

Situation: Standard Statement.

Comment **146**: Nitrogen recommendation guidelines: For establishment year, apply 75 lbs of N per acre. Second year, apply a suggested total of 100 to 150 lbs N/A. After second year, apply a suggested total of 150 to 170 lbs N/A per year. Apply the nitrogen 30 to 45 days after emergence. On light, sandy soils split the N application. Do not apply N after flowering starts to avoid excessive vegetative growth.

Situation: If B < 1.5 ppm.

Comment **656**: Broadcast 1.0 pound of elemental boron per acre.

Situation: Standard Statement.

Comment **705**: On very sandy soils (sands, loamy sands) where the clay layer is more than 20 inches below the surface, apply 30 lbs of sulfur per acre. Note – on heavier soils (sandy loams, loams) or sands where the clay layer is less than 20 inches from the surface, no response to sulfur is expected.

Crop Code: 201, 203

Crop: New Lawn Establishment - Kentucky Bluegrass, Fescue, Ryegrass, Bermudagrass, Zoysiagrass

Target pH = 6.5 with lime possibly recommended at pH of 6.4 or less

See Notes: 1, 17 or 18

Soil Test Level		Comment No.	Fertilizer Recommendations
P ₂ O ₅	K ₂ O		
L-M	L-H	*201	FERTILIZER RECOMMENDATIONS: Apply a 1-2-1 ratio fertilizer (examples of grades to use are 5-10-5, 15-30-15, etc.) Using the rate listed in the "1.0" LB. nitrogen column in Table 2 in the note on lawn fertilization. Be sure to incorporate the fertilizer into the soil (along with lime, if needed) to a depth of 4 to 6 inches. After the turf has been established (6 to 8 weeks) follow one of the maintenance fertilization programs described in the Note.
L-M	VH	*202	FERTILIZER RECOMMENDATIONS: Apply 10 lbs. of 0-46-0 per 1000 sq. ft. to correct a shortage of phosphate in the soil. Also apply a nitrogen-only fertilizer (examples are 31-0-0, 33.5-0-0, 38-0-0, 46-0-0, etc.) using the rate listed in the "1.0" lb. nitrogen column in Table 2 in the Note on lawn fertilization. Be sure to incorporate the fertilizer into the soil (along with lime, if needed) to a depth of 4 to 6 inches. After the turf has been established (6 to 8 weeks) follow one of the maintenance fertilization programs described in the Note. OPTIONAL PROGRAM. If 0-46-0 or a nitrogen-only fertilizer is not available, they can both be replaced by using a complete fertilizer with a 1-2-1 ratio (examples of grades to use are 5-10-5, 15-30-15, etc.) using the rate listed in the "1.0" lb. nitrogen column in Table 2 in the Note on lawn fertilization. Note - this optional program, while meeting the turf's nutrient needs, provides extra potash which is not necessary for optimum growth.

(Continued on next page.)

H-VH	L-M	*203	<p>FERTILIZER RECOMMENDATIONS: Apply 5 lbs. of 0-0-50 or 4 lbs. of 0-0-60 per 1000 sq. ft. to correct a shortage of potash in the soil. Also apply a nitrogen-only fertilizer (examples of grades to use are 31-0-0, 33.5-0-0, 38-0-0, 46-0-0, etc.) using the rate listed in the "1.0" lb. nitrogen column in Table 2 in the Note on lawn fertilization. Be sure to incorporate the fertilizer into the soil (along with lime, if needed) to a depth of 4 to 6 inches. After the turf has been established (6 to 8 weeks) follow one of the maintenance fertilization programs described in the note.</p> <p>OPTIONAL PROGRAM: If the above fertilizer materials cannot be found, they can all be replaced by using a complete fertilizer with a 2-1-2 ratio (examples of grades to use are 14-7-14, etc.) using the rate listed in the "1.0" lb. nitrogen column in Table 2 in the Note on lawn fertilization. Note - this optional program, while meeting the turf's nutrient needs, provides extra phosphate which is not necessary for optimum growth.</p>
H-VH	H-VH	*204	<p>FERTILIZER RECOMMENDATIONS: Apply a nitrogen-only fertilizer (examples of grades to use are 31-0-0, 33.5-0-0, 46-0-0, etc.) using the rate listed in the "1.0" lb. nitrogen column in Table 2 in the Note on lawn fertilization. Be sure to incorporate the fertilizer into the soil (along with lime, if needed) to a depth of 4 to 6 inches. After the turf has been established (6 to 8 weeks) follow one of the maintenance fertilization programs described in the note.</p>

(Continued from previous page.)

Crop Code: 202, 204

Crop: Lawn Maintenance, Repair of Bare Spots - Kentucky Bluegrass, Fescue, Ryegrass, Bermudagrass, Zoysiagrass, St. Augustine

Target pH = 6.5 with no lime recommended until soil pH is 6.2 or less

See Notes: 1, 17 or 18

Soil Test Level		Comment No.	Fertilizer Recommendations
P ₂ O ₅	K ₂ O		
L-M	L	*205	FERTILIZER RECOMMENDATIONS: Apply a 1-1-1, 1-2-2 or 2-1-1 ratio fertilizer (examples of grades to use are 10-10-10, 5-10-10, 10-20-20, 16-8-8, etc.) according to the instructions in the Note on Lawn Fertilization.
L-M	M-VH	*206	FERTILIZER RECOMMENDATIONS: Apply a 2-1-1 ratio fertilizer (example of a grade to use is 16-8-8) according to the instructions in the Note on lawn fertilization.
H-VH	L	*207	FERTILIZER RECOMMENDATIONS: Apply a 2-0-1 or 3-0-1 ratio fertilizer, such as 22-0-14, 32-0-10, 19-0-7 or a similar ratio turf maintenance product according to the instructions in the Note on lawn fertilization.
H-VH or H	M-H or VH	*208	FERTILIZER RECOMMENDATIONS: Use any phosphorus free maintenance "turf-type" fertilizer according to the instructions in the Note on lawn fertilization. (A "turf-type" fertilizer is typically high in nitrogen, and has little or no phosphorus and potassium, e.g., 25-0-7.)
VH	VH	*209	FERTILIZER RECOMMENDATIONS: Apply a nitrogen-only fertilizer according to the instructions in the note on lawn fertilization listed in the Note box in the upper right of this report.

Soil Test Level		Comment No.	Fertilizer Recommendations
P ₂ O ₅	K ₂ O		
L-M	L-M	*221	FERTILIZER RECOMMENDATIONS: Apply 4 lbs (10 cups) of 5-10-10 or 2 lbs of 10-20-20 per 100 sq. ft. For additional information on fertilization, see Note 19.
L-M	H-VH	*222†	FERTILIZER RECOMMENDATIONS: Apply 4 lbs (9 cups) of 5-10-5 per 100 sq. ft. For additional information on fertilization, see Note 19.
H	L-VH	*223	FERTILIZER RECOMMENDATIONS: Apply 2 lbs (4 1/2 cups) of 10-10-10 per 100 sq. ft. For additional information on fertilization, see Note 19.
VH	L	*224‡	FERTILIZER RECOMMENDATIONS: Apply 1.5 lbs (3 cups) of potassium nitrate (13-0-44) per 100 sq. ft. If you are unable to find this fertilizer, apply 2 lbs (4 1/2 cups) of 10-10-10 per 100 sq.ft. For additional information on fertilization, see Note 19.
VH	M-VH	*225	FERTILIZER RECOMMENDATIONS: Apply a nitrogen-only fertilizer, such as one of the following amounts per 100 sq. ft. – 1.25 lbs (2 cups) of nitrate of soda (16-0-0) or 1.33 lbs (2 2/3 cups) of calcium nitrate (15-0-0) or 1.0 lb (2 ½ cups) of ammonium sulfate (21-0-0) or 0.4 lbs (1 cup) of urea (46-0-0). Do not over fertilize! These products will burn plants at high rates! If you are unable to find one of these fertilizers, apply a turf-type (lawn maintenance) fertilizer that is high in nitrogen with little or no phosphorus and potassium at a rate close to 0.2 lb of nitrogen per 100 sq. ft., such as applying two-thirds of a pound of either 26-0-2 or 32-0-4. For additional information on fertilization, see Note 19.

† A substitute for comment *222 is to apply 1 lb (2 cups) of diammonium phosphate (18-46-0), or apply 2 lbs (4 1/2 cups) of normal superphosphate (0-20-0) along with a nitrogen-only fertilizer suggested in comment *225.

‡ Potassium nitrate or saltpeter may be found in a garden supply store, but can be found at a big-box store, such as Home Depot or Lowes, as a granular stump decomposer or remover. Look for the Spectracide brand near the insecticides.

or
Apply 1 lb (1 ¾ cups) of muriate of potash (0-0-60) along with a N-only fertilizer suggested in comment *225.

Crop Code: 220, 226-230, 232, 234

Crop: Home Fruit Trees - Apples, Nectarines, Peaches, Pears, Plums, Quince, Sour Cherry, Sweet Cherry

Target pH = 6.5

See Notes: 1, 21

Soil Test Level		Comment No.	Fertilizer Recommendations
P ₂ O ₅	K ₂ O		
L	L	*243	FERTILIZER RECOMMENDATIONS: Complete Fertilizer Needed - See Note 21.
L	M-VH	*243	FERTILIZER RECOMMENDATIONS: Complete Fertilizer Needed - See Note 21.
M-VH	L	*243	FERTILIZER RECOMMENDATIONS: Complete Fertilizer Needed - See Note 21.
M-VH	M-VH	*244	FERTILIZER RECOMMENDATIONS: Nitrogen-only Fertilizer Needed - See Note 21.

Crop Code: 221-225, 231, 233

Crop: Small Fruits for Home Use - Blackberries, Blueberries, Currants, Gooseberries, Grapes, Raspberries, Strawberries

Target pH = 6.5, except 5.2 for Blueberries

See Notes: 1, 22

Soil Test Level		Comment No.	Fertilizer Recommendations
P ₂ O ₅	K ₂ O		
L	L	*241	FERTILIZER RECOMMENDATIONS: Complete Fertilizer Needed - See Note 22.
L	M-VH	*241	FERTILIZER RECOMMENDATIONS: Complete Fertilizer Needed - See Note 22.
M-VH	L	*241	FERTILIZER RECOMMENDATIONS: Complete Fertilizer Needed - See Note 22.
M-VH	M-VH	*242	FERTILIZER RECOMMENDATIONS: Nitrogen-only Fertilizer Needed - See Note 22.

Crop Code: 240, 241, 242, 243, 244

Crop: Azaleas, Andromedas, Camellias, Laurel, Rhododendron

Target pH = 5.2

See Notes: 1, 20

Comment No.	Fertilizer Recommendations
*261	FERTILIZER RECOMMENDATIONS: See Note 20.

Crop: Shrubs, Non Acid-Loving

Crop Code: 245

Target pH = 6.5

See Notes: 1, 20

Comment No.	Fertilizer Recommendations
*261	FERTILIZER RECOMMENDATIONS: See Note 20.

Crop: Trees

Crop Code: 246

Target pH = 6.2

See Notes: 1, 20

Comment No.	Fertilizer Recommendations
*261	FERTILIZER RECOMMENDATIONS: See Note 20.

Crop: Potted House Plants

Crop Code: 250

Target pH = 6.5

See Notes: 1, 19

Comment No.	Fertilizer Recommendations
*281	FERTILIZER RECOMMENDATIONS: See Note 19.

Crop Code: 301-323, 353-354

Crop: Greenhouse Production - Carnations, Chrysanthemums, Snapdragons, Azaleas, Lilies, Poinsettias, Bedding Plants, Foliage Plants, Hanging Baskets, Vegetable Transplants; Nursery Production - Container-Grown Acid-Loving Plants, Container-Grown Non-Acid-Loving Plants (Also see Crops 351-352)

Target pH = 6.5, except 5.2 for Azaleas, Poinsettias, and Container-Grown Acid-Loving Plants

See Notes: 1, 13

Soil Test Level		Comment No.	Fertilizer Recommendations
P ₂ O ₅	K ₂ O		
L-M	L-VH	*301	FERTILIZER RECOMMENDATIONS: Apply 1/2 to 3/4 lbs of 20-20-20 per 100 sq. ft. or per 25 gal of water.
H	L-VH	*302	FERTILIZER RECOMMENDATIONS: Apply 1/2 to 3/4 lbs of 20-5-30 per 100 sq. ft. or per 25 gal of water.
VH	L-H	*302	FERTILIZER RECOMMENDATIONS: Apply 1/2 to 3/4 lbs of 20-5-30 per 100 sq. ft. or per 25 gal of water.
VH	VH	*303	FERTILIZER RECOMMENDATIONS: Only supplemental N fertilizer is needed. Apply 1/2 lb of calcium nitrate per 100 sq. ft. (or 1/4 lb of calcium nitrate per 25 gal of water.)

Crop Code: 351-352

Crop: Nursery Production - Field Grown Acid-Loving Plants, Field Grown Non-Acid-Loving Plants (Also see Crops 353-354)

Target pH = 5.2 and 6.5, respectively

See Notes: 1, 13

Soil Test Level		Comment No.	Fertilizer Recommendations
P ₂ O ₅	K ₂ O		
L-M	L-VH	*321	FERTILIZER RECOMMENDATIONS: Apply 2000 lbs of 5-10-5 per acre.
H	L-VH	*322	FERTILIZER RECOMMENDATIONS: Apply 1000 lbs of 10-10-10 per acre.
VH	VH	*323	FERTILIZER RECOMMENDATIONS: Apply 150 lbs of ammonium nitrate per acre in early spring.

Crop Code: 420, 421, 422, 423

Crop: Surface - Mined Areas: Erosion Control Mixtures, Hay and Pasture Mixtures, Critical Area Mixtures, Temporary Cover Mixtures

Target pH = 6.2 with lime possibly recommended at pH of 6.1 or less

See Notes: 1, 3

Soil Test Level	Fertilizer Recommendations (lb/A)		
	N	P ₂ O ₅	K ₂ O
L	50	90 - 120	60 - 90
M		60 - 90	30 - 60
H		30 - 60	30
VH		0	0

Comments to Accompany Recommendations:

Situation: Standard Statement.

Comment **632:** If Sericea Lespedeza is to be used in the mixture, less lime may be required.

Situation: Standard Statement.

Comment **701:** THE PHOSPHORUS TEST USED BY THIS LABORATORY WHICH WAS DESIGNED FOR REGULAR FIELD SOILS IS NOT CONSISTENTLY RELIABLE FOR SURFACE MINED SOILS. PLANT AVAILABLE PHOSPHORUS IS OFTEN OVER-ESTIMATED. THE PHOSPHORUS RECOMMENDATION ABOVE WAS MADE INDEPENDENTLY OF THE SOIL TEST AND IS BASED ON RESEARCH FINDINGS ON SURFACE-MINED LAND

FERTILIZER RECOMMENDATIONS - SECONDARY PLANT NUTRIENTS

Calcium (Ca), magnesium (Mg), and sulfur (S) are usually referred to as the secondary elements since these are required in lesser amounts than N, P, and K. The following is a discussion of fertilizer recommendations for each of these elements.

Calcium (Ca)

Calcium is a secondary element normally supplied to the plant in the form of limestone. The calcium level is rarely low enough to cause deficiencies in crops other than peanuts and some vegetables. In most situations where the Ca test is low, the soil pH is also low and the lime application recommended to correct the pH will add ample amounts of calcium to the soil. Either calcitic limestone or dolomitic limestone can be used because both contain ample amounts of calcium.

Regarding *peanuts*, gypsum or landplaster (CaSO_4) is recommended to suppress excess uptake of potassium by the peanut peg. The rates recommended are: broadcast - 900 lbs per acre, or banded in the row - 600 lbs per acre. The gypsum that is used should contain at least 90% calcium sulfate. Calcium is not recommended for any other crops.

Regarding *Christmas tree crops*, when the soil test calcium level is rated less than high and no lime is needed to raise the soil pH, then supply additional calcium by applying gypsum (CaSO_4) at a rate indicated in a table in Soil Test Note 23. Even when lime is recommended but the Ca level is rated low, additional Ca beyond what the lime will supply is desirable. In this case, apply 10 to 12 ounces of gypsum per tree.

Magnesium (Mg)

Magnesium is another secondary element that is normally supplied to the plant in the form of limestone. Deficiencies of this element may occur when the Mg test level is Low or Low-. At these levels, the soil pH is also usually low and dolomitic limestone, which contains ample amounts of magnesium, should be recommended. In situations where the soil pH is optimum and no lime is needed but Mg tests Low or Low-, a separate magnesium fertilizer will be required. The recommended rate is: 30 lbs of magnesium (Mg) per acre (20 lbs Mg/acre for Christmas trees) in a soluble form such as magnesium sulfate, sulfate of potash magnesia, or promesium. Magnesium can also be applied as a foliar spray using magnesium sulfate at the rate of 3-4 lbs of actual magnesium per acre.

Sulfur (S)

Sulfur is the third of the secondary elements that is required by plants for optimum growth. It is normally supplied to plants in the form of rainfall containing sulfur gases from the atmosphere and sulfur-containing fertilizers. Sulfur crop needs were evaluated in Virginia in the mid 1950's, initiated again in the late 1960's, and continued up to the present time. Crop response to sulfur has been inconsistent and more research is needed before this element can be put on the recommendation list for Virginia crops.

FERTILIZER RECOMMENDATIONS - MICRONUTRIENTS

Crop Micronutrient Needs

Micronutrients are those elements that are required by plants in small amounts. They are sometimes referred to as trace elements and consist of zinc (Zn), manganese (Mn), boron (B), molybdenum (Mo), copper (Cu), iron (Fe), and chlorine (Cl). The primary source of micronutrients for plants is the soil. However, under certain conditions and for certain soils in Virginia, one or more micronutrients may be needed by certain crops for optimum growth. Extensive research has been conducted in Virginia over the past decades on micronutrients. Two of these elements, zinc and manganese, have been found to be deficient for certain major agronomic crops grown in Virginia, and soil tests, calibrated for Virginia soils, have been successfully developed for these crops. A third element, boron, has also been found to be deficient for certain Virginia crops, but efforts to successfully develop a soil test have not occurred except for alfalfa. Boron is only recommended for alfalfa when the soil test level is less than 1.0 ppm. For the crops that require supplementary boron for optimum growth and for which deficiencies have been observed, a general boron recommendation is made. A fourth micronutrient, molybdenum, is deficient for certain crops under conditions of low soil pH and recommendations are made accordingly to correct the deficiency. The remaining three micronutrients - copper, iron, and chlorine have not normally been found to be deficient on crops in Virginia and are not recommended.

The following is information on fertilizer recommendations for trace elements found to be deficient in Virginia.

Zinc (Zn)

Zinc deficiency has been found on corn, small grains, and grain sorghum in Virginia. The critical zinc soil test level depends on soil pH (See Soil Test Calibration section). Zinc recommendations depend on the application method. Refer to Soil Test Note 4 (available at www.soiltest.vt.edu) for the suggested method rates.

Manganese (Mn)

Manganese deficiency has been found on soybeans and peanuts grown in Virginia. The critical manganese soil test level depends on soil pH (See Soil Test Calibration section). If manganese is needed, refer to Soil Test Note 4 (available at www.soiltest.vt.edu) for the suggested rates and methods of application for these crops.

Boron (B)

Boron deficiency has been found on alfalfa, apples, cotton, peanuts, and on several commercial vegetable crops grown in Virginia. For apples see Soil Test Note 10 (available at www.soiltest.vt.edu), and for the other crops, refer to Soil Test Note 4 for the suggested rates and methods of boron application for the particular crop to be grown.

Molybdenum (Mo)

Molybdenum deficiency has been found on alfalfa, soybeans, and on certain commercial vegetable crops grown in Virginia. Molybdenum is recommended when the soil pH is less than 5.8. If molybdenum is needed, see Soil Test Note 4 (available at www.soiltest.vt.edu) for the suggested rates and methods of application for the particular crop to be grown.

RAISING SOIL PH WITH LIME

How Recommendations Are Made

Lime recommendations are based on the following factors:

1. Crop to be Grown
2. Soil (Water) pH
3. Buffer Index/pH (total acidity measured using the Mehlich buffer)
4. Credit For Previous Lime Application

The following is a discussion of each of these factors:

1. **Crop to be Grown.** The target or optimum soil pH for the crop to be grown is considered in making the recommendation. Target pH (TpH) for the various crops, listed according to crop code number, is found in the following table.

Target pH†	Crop Code No.‡
5.2	63, 64, 98, 105, 106, 109-111, 114, 116, 222, 240-244, 310, 313, 351, 353, 463, 464
5.8	15-17, 48, 107, 113
6.2	1-14, 18-23, 31-36, 38-47, 52-62, 65-70, 74, 75, 95-97, 99, 115, 246, 401-423, 438-462, 465-469, 495-497
6.5	71-73, 76, 80-94, 201-204, 210-212, 220, 221, 223-234, 245, 250, 301-303, 311, 312, 320-323, 352, 354, 471, 488
6.8	30, 37, 50, 51, 437

† Target pH (TpH) is for mineral soils. For organic soils, the target pH is 5.2 for all Crops.

‡ For a list of crop names corresponding to the numbers in this table, refer to the Crop/Plant Codes on the Soil Sample Information Sheets, (www.soiltest.vt.edu).

2. **Soil (water) pH.** Soil pH (or soil reaction) measures the active acidity in the soil's water. This value is used to decide whether a lime requirement is determined, but is not used in calculating the amount of lime recommended. No lime is recommended until the soil pH is 0.2 or more units below the target pH (with a minimum recommendation of 0.50 T/A), except when establishing turf, forage or forest tree, in which case it's 0.1 units below TpH. Soil pH is used in other ways, e.g., in triggering report comments and in the calculations of micronutrient availability indexes.
3. **Buffer Index or Buffer pH.** The buffering capacity (ability to resist a change in pH) of the soil is measured using the Mehlich buffer solution. The buffer index provides an indication of the total (active + residual or reserve) acidity, which has a major effect on the lime recommendation. In general, sandy soils have little reserve acidity while clayey soils have much more reserve acidity. For this reason, it takes considerably more lime to raise the pH of a clay soil than it does a sandy soil.
4. **Credit for Previous Lime Application.** Limestone has a residual effect in the soil; i.e., it will remain in the soil and affect acidity for 2 to 3 or more years. Because of this, recent lime applications that were made before a soil sample was collected for analysis should be considered when making a lime recommendation.

Previous Lime Credit

The following allowances for previous lime applications made within the past 2 years are used to adjust the lime recommendation for the crop to be grown:

Last Lime Application, Months	Allowance For Previous Amount Applied, %
1. None applied	0
2. 1 - 6	75
3. 7 - 12	50
4. 13 - 18	25
5. > 18	0

According to the table, if a person applied two tons/acre of lime 12 months ago, he/she would be credited for one ton of lime/acre, i.e., one T/A would be subtracted from the recommendations.

This relationship is based on research conducted in Virginia by Moeschler (VPI & SU Tech. Bull.159, 1962) where lime effects were studied on 11 soil types. For 9 of the 11 soils, the pH reached its maximum in 2 years. On the remaining 2 soils, it took between 2 1/2 to 3 years to reach the maximum. If 2 years is assumed to be the cutoff point for complete reaction, then at one year 50% of the lime would have reacted and, hence, the 50% allowance. Also, the lime on the market today is most likely finer than the lime Moeschler used in his study and would probably react faster.

Conversion Factors (Some Values are Approximate)

- 1 pound of ground limestone or ground dolomitic limestone \approx 1.5 cups
- 2 pounds of wood ash \approx 1 pound of limestone (apply max. of 2 lbs of wood ash / 100 sq. ft. per year)
- 1 acre = 43,560 square feet
- Tons per acre x 46 = pounds per 1,000 square feet
- Pounds per acre x 0.023 = pounds per 1,000 square feet
- Pounds per 1,000 square feet x 43.6 = pounds per acre
- Pounds per 1,000 square feet x 0.1 = pounds per 100 square feet
- Pounds per 100 square feet x 0.54 = pounds per cubic yard
- 1 bushel = 35.24 liters = 1.25 cubic feet
- 1 quart = 2 pints = 4 cups
- 1 tablespoon = 3 teaspoons

Lime Recommendations For Potted House Plants

pH Desired = 6.5	
pH of Unlimed Soil	Lime, Teaspoons/5" pot
4.4	3.0
4.7	2.5
5.1	2.0
5.4	1.5
5.8	1.0
6.1	0.5

Lime Recommendations for Virginia Crops in Tons per Acre

**Lime Rates in T/A of Ag Lime
(rounded to the nearest quarter ton)**

Buffer Index	Target pH					Acidity
	5.2	5.8	6.2	6.5	6.8	meq/100g
6.60	0.00	0.00	0.00	0.00	0.00	0.00
6.50	0.00	0.00	0.00	0.00	0.00	0.03
6.40	0.00	0.00	0.00	0.00	0.50	0.06
6.38	0.00	0.00	0.00	0.50	0.75	0.12
6.36	0.00	0.00	0.50	0.50	0.75	0.24
6.34	0.00	0.00	0.50	0.50	1.00	0.36
6.32	0.00	0.00	0.50	0.75	1.00	0.48
6.30	0.00	0.00	0.75	0.75	1.25	0.59
6.28	0.00	0.00	0.75	1.00	1.25	0.71
6.26	0.00	0.50	1.00	1.00	1.50	0.83
6.24	0.00	0.50	1.00	1.25	1.75	0.95
6.22	0.00	0.50	1.25	1.50	1.75	1.07
6.20	0.00	0.75	1.25	1.50	2.00	1.19
6.18	0.00	0.75	1.50	1.75	2.00	1.30
6.16	0.00	1.00	1.50	1.75	2.25	1.42
6.14	0.50	1.00	1.75	2.00	2.50	1.54
6.12	0.50	1.25	1.75	2.00	2.50	1.66
6.10	0.50	1.25	2.00	2.25	2.75	1.78
6.08	0.50	1.50	2.00	2.25	2.75	1.90
6.06	0.75	1.50	2.25	2.50	3.00	2.02
6.04	0.75	1.75	2.25	2.75	3.00	2.13
6.02	1.00	1.75	2.50	2.75	3.25	2.25
6.00	1.00	2.00	2.75	3.00	3.50	2.37
5.95	1.50	2.25	3.00	3.25	3.75	2.67
5.90	1.75	2.50	3.25	3.50	4.00	2.96
5.85	2.00	3.00	3.50	4.00	4.50	3.26
5.80	2.25	3.25	4.00	4.25	4.75	3.56
5.75	2.50	3.50	4.25	4.75	5.25	3.85
5.70	3.00	3.75	4.50	5.00	5.50	4.15
5.65	3.25	4.25	5.00	5.25	6.00	4.45
5.60	3.50	4.50	5.25	5.75	6.25	4.74
5.55	3.75	4.75	5.50	6.00	6.75	5.04
5.50	4.00	5.00	5.75	6.50	7.00	5.34
5.40	4.75	5.75	6.50	7.00	7.75	5.93
5.30	5.25	6.5	7.25	7.75	8.50	6.52
5.20	5.75	7.00	7.75	8.50	9.25	7.11
5.10	6.50	7.50	8.50	9.25	9.75	7.71
5.00	7.00	8.25	9.00	10.00	10.50	8.30
4.75	8.50	9.75	10.75	11.75	12.50	9.78
4.50	10.00	11.25	12.25	13.50	14.25	11.26
4.25	11.50	12.75	14.00	15.25	16.00	12.75
4.00	13.00	14.50	15.50	17.00	17.75	14.23

**A minimum of 0.50 T/A is recommended,
when the soil pH is more than 0.2 units below the target pH.**

Example: Assuming the crop to be grown is crop code # 1, corn, then the target pH is 6.2. In addition if the buffer index is 6.08, then the lime recommendation will be 2 T/A. (If there is no Previous Lime Credit.)

Lime Recommendations for Virginia Plants in Pounds per 1,000 sq. ft.

**Lime Rates in lbs/1,000 sq. ft. of Ag Lime
(rounded to the nearest 10 pounds)**

Buffer Index	Target pH					Acidity
	5.2	5.8	6.2	6.5	6.8	meq/100g
6.60	0	0	0	0	0	0.00
6.50	0	0	0	0	0	0.03
6.40	0	0	0	0	20	0.06
6.38	0	0	0	20	30	0.12
6.36	0	0	20	20	40	0.24
6.34	0	0	20	20	40	0.36
6.32	0	0	30	30	50	0.48
6.30	0	0	30	40	60	0.59
6.28	0	0	40	40	60	0.71
6.26	0	20	40	50	70	0.83
6.24	0	20	50	60	80	0.95
6.22	0	30	60	60	80	1.07
6.20	0	30	60	70	90	1.19
6.18	0	40	70	80	100	1.30
6.16	0	40	70	80	100	1.42
6.14	20	50	80	90	110	1.54
6.12	20	60	90	100	120	1.66
6.10	20	60	90	100	120	1.78
6.08	30	70	100	110	130	1.90
6.06	30	70	100	110	140	2.02
6.04	40	80	110	120	140	2.13
6.02	50	80	110	130	150	2.25
6.00	50	90	120	130	160	2.37
5.95	60	100	140	150	170	2.67
5.90	80	120	150	170	190	2.96
5.85	90	130	160	180	210	3.26
5.80	110	150	180	200	220	3.56
5.75	120	160	190	210	240	3.85
5.70	130	180	210	230	250	4.15
5.65	150	190	220	250	270	4.45
5.60	160	200	240	260	290	4.74
5.55	170	220	250	280	300	5.04
5.50	190	230	270	290	320	5.34
5.40	210	260	300	330	350	5.93
5.30	240	290	330	360	390	6.52
5.20	270	320	360	390	420	7.11
5.10	300	350	390	420	450	7.71
5.00	320	380	420	450	490	8.30
4.75	390	450	490	530	570	9.78
4.50	460	520	560	620	650	11.26
4.25	530	590	640	700	730	12.75
4.00	600	660	710	780	820	14.23

**A minimum of 20 lbs/1,000 sq. ft. is recommended,
when the soil pH is more than 0.2 units below the target pH.**

Example: For a lawn, the target pH is 6.5. If the buffer index is 6.24, then the lime recommendation will be 60 lbs/1,000 sq ft. (If the Previous Lime Credit is zero.) Reported as 6 lbs/100 sq ft for gardens.

Lime Recommendation Calculations

Lime Recommendation equations (in T/A) for given target pH:

If Target pH = 5.2, then L.R. = ((59 - 9.54 BpH) 0.5) x (1.25 Aglime Effectiveness Factor)

If Target pH = 5.8, then L.R. = ((63 - 9.98 BpH) 0.5) x 1.25

If Target pH = 6.2, then L.R. = ((66 - 10.30 BpH) 0.5) x 1.25

If Target pH = 6.5, then L.R. = ((71.74 - 11.18 BpH) 0.5) x 1.25

If Target pH = 6.8, then L.R. = ((74.54 - 11.52 BpH) 0.5) x 1.25

where: L.R. = Lime Recommendation in T/A (tons per acre), and BpH = buffer index, e.g., 6.14

A minimum 0.5 T/A is recommended when soil pH is more than 0.2 units below the crop's target pH.

The preceding tables are from the equations above and assume a 6 to 8 inch plow depth (2 million pounds of soil per AFS, Acre Furrow Slice) and the use of pulverized limestone. (Pulverized limestone has a minimum guaranteed amount of 90% passing through a 20-mesh screen and 70% passing through a 100-mesh screen size.) These equations were developed from a 3-month lime incubation study conducted in 2003 on 17 different Virginia soils. A multiplier of 1.25 is added to the equations in order to compensate for aglime being less reactive and therefore less efficient than the reagent-grade CaCO₃ used in the calibration study.

Lime Rate Adjustment for CCE

The lime recommendation that appears on a soil test report is based on the use of a liming material with a 100% Total Neutralizing Power (TNP) or Calcium Carbonate Equivalent (CCE). The use of any liming material that is not equivalent in neutralizing power to pure calcium carbonate limestone (100% CCE) must be adjusted so that one applies the correct amount of liming material to neutralize the acidity in the soil. Using the CCE of the liming material, the amount required to supply the recommended amount of neutralizing power for the soil may be calculated as follows.

Calculation of Actual Lime Requirement:

$$\text{Actual Liming Material Required} = \frac{\text{Soil Test Lime Recommendation}}{\text{CCE of liming material to be used}} \times 100$$

Example:

Lime recommendation reported to apply is 2.0 T/A.

Liming material label states that it has a Calcium Carbonate Equivalent (CCE) = 80%.

Actual amount of this liming material to apply = 2.5 T/A or (2.0/80) x 100

% CCE of Your Liming Material

T/A*	50	60	70	80	90	100	110	120	130	140	150	160	170	180
0.5	1.00	0.75	0.75	0.75	0.50	0.50	0.50	0.50	0.50	0.25	0.25	0.25	0.25	0.25
1.0	2.00	1.75	1.50	1.25	1.00	1.00	1.00	0.75	0.75	0.75	0.75	0.75	0.50	0.50
1.5	3.00	2.50	2.25	2.00	1.75	1.50	1.25	1.25	1.25	1.00	1.00	1.00	1.00	0.75
2.0	4.00	3.25	2.75	2.50	2.25	2.00	1.75	1.75	1.50	1.50	1.25	1.25	1.25	1.00
2.5	5.00	4.25	3.50	3.25	2.75	2.50	2.25	2.00	2.00	1.75	1.75	1.50	1.50	1.50
3.0	6.00	5.00	4.25	3.75	3.25	3.00	2.75	2.50	2.25	2.25	2.00	2.00	1.75	1.75
3.5	7.00	5.75	5.00	4.50	4.00	3.50	3.25	3.00	2.75	2.50	2.25	2.25	2.00	2.00
4.0	8.00	6.75	5.75	5.00	4.50	4.00	3.75	3.25	3.00	2.75	2.75	2.50	2.25	2.25

*Reported Lime Recommendation

CCE examples: Burned or Quick lime, CaO, is 150 to 180, and wood ashes is 40 to 50.

For more information about different liming materials, refer to VCE publication 452-510.

Determination of Lime Type

If Mg soil test rating is either Low (L) or Very Low (L-), then dolomitic limestone is recommended.

If Ca soil test rating is low (L-, L or L+) and Mg is Very High, then calcitic limestone is recommended.

Otherwise “AG” or agricultural lime is recommended, meaning that any agricultural lime will do, since the calcium and magnesium needs will be covered by using either type of lime.

Estimation of CEC by Summation

The Cation Exchange Capacity (CEC) can reasonably be estimated by summation of Mehlich 1 extractable bases, Ca, Mg and K, plus the exchangeable acidity, estimated from the Mehlich soil-buffer pH (buffer index), after conversion of all analytical results to meq/100 g, which is equivalent to cmol(+)/kg. This method is inappropriate for soils with a high soluble salts level or for alkaline soils, since these soils may be calcareous, gypsiferous, or relatively unweathered and could result in an erroneously high CEC value by the dissolution of nonexchangeable cations.

Calculation:

Estimated Soil CEC = Acidity + Ca + Mg + K (in the units of meq/100g soil or cmol(+)/kg)

Exchangeable acidity is estimated from the Mehlich buffer pH measurement according to the following equation, which was developed from Virginia soils with a comparison of Mehlich soil-buffer pH to the acidity needed to be neutralized to raise the soil pH to 6.5 from whole soil titrations.

meq Acidity / 100 g of soil = (-5.928 x BpH) + 37.94

where BpH = Mehlich buffer pH reading (reported buffer index) for an individual soil sample.

A BpH greater or equal to 6.4, but less than 6.6 is assigned acidity between 0.06 and 0.01 meq/100g. A BpH of 6.6, the initial starting pH of the Mehlich buffer solution, is reported to have zero acidity. When the water pH is 7.0 or greater and a buffer pH is not determined, the acidity is reported to be zero, and the % Base Saturation is reported as 100.

meq Ca /100 g = lb Ca per Acre ÷ 401

meq Mg /100 g = lb Mg per Acre ÷ 243

meq K /100 g = lb K per Acre ÷ 782

Example:

If BpH = 6.16, and the cations in lbs/Acre are Ca = 1084, Mg = 252, K = 102, then

Soil Est-CEC = Acidity + Ca + Mg + K

Soil Est-CEC = 1.42 + 2.70 + 1.04 + 0.13 = 5.3 meq/100g soil.

Other Reported Values: (All values should be in the same units, e.g. meq/100g.)

% Acidity = (Acidity / CEC) x 100

% Base Saturation = ((Ca + Mg + K) / CEC) x 100

% Calcium Saturation = (Ca / CEC) x 100

% Magnesium Saturation = (Mg / CEC) x 100

% Potassium Saturation = (K / CEC) x 100

Example Values

26.8% Acidity

73.2% Base Sat.

50.9% Ca Sat.

19.6 % Mg Sat.

2.5% K Sat.

LOWERING SOIL PH WITH SULFUR

On occasion, it is necessary to increase the acidity of the soil for certain "acid-loving" plants such as blueberries, azaleas, and rhododendron which grow best under acid conditions. The following are guidelines for lowering soil pH with sulfur:

1. For crops with optimum pH of 6.0 - 6.8, no sulfur is usually recommended regardless of how high the soil pH is because most crops in this category will tolerate a pH of 7.0 - 8.0 and grow well. Also, in most cases, the soil pH will gradually decrease with time.
2. For crops requiring pH of 5.5 - 6.0, sulfur is usually required to adjust the pH to 5.5 when the soil pH is above optimum.
3. For crops requiring a pH of 5.0 - 5.5, sulfur will be required to adjust the pH to 5.0 when it is above optimum.
4. **No more than 15 lbs of S/1,000 sq.ft. (1.5 lbs S/100 sq. ft.; 9 lbs iron sulfate or aluminum sulfate/100 sq. ft.) should be applied at any one time to existing plants.** Instead, the soil should be retested in 4 to 6 months to determine if further sulfur applications are needed.

The following table contains rates of sulfur to apply to reduce soil pH. **S** is for sandy soils. **L** is for loamy soils. **C** is for clayey soils.

		Reducing Soil pH With Sulfur														
		Desired Soil pH														
Initial Soil pH		4.0			4.5			5.0			5.5			6.0		
		S	L	C	S	L	C	S	L	C	S	L	C	S	L	C
		----- Sulfur Required [†] , lbs per 1,000 sq. ft. [‡] -----														
4.0		0	0	0												
4.5		4	10	16	0	0	0									
5.0		8	20	32	4	10	16	0	0	0						
5.5		12	29	47	8	20	32	4	10	16	0	0				
6.0		15	38	61	12	29	47	8	20	32	4	10	16	0	0	0
6.5		19	48	77	15	38	61	12	29	47	8	20	32	4	10	16
7.0		23	57	92	19	48	77	15	38	61	12	29	47	8	20	32
7.5		27	67	107	23	57	92	19	48	77	15	38	61	12	29	47

[†]To use aluminum sulfate (for hydrangeas) or iron sulfate (copperas) multiply pounds of sulfur by 6. These sulfate salts will provide a more rapid plant response than sulfur, but will cost more and not be effective as long. Keep well watered due to salt hazard. *See comment # 630.*

[‡] For lb/100 sq.ft. or oz/ 2 ½ bu. move decimal one place to left. For lbs/acre multiply by 43.56.

Example: Assuming the soil pH is 6.5 in a loamy soil and the pH should be reduced to 5.5, reading across from pH 6.5 to the "loamy" column under pH 5.5, 20 pounds of sulfur per 1,000 square feet is required to reduce the soil pH to 5.5.

Approximate Weight to Volume Conversions

- 1 pound of sulfur ≈ 3 1/3 to 4 cups
- 1 pound of aluminum sulfate ≈ 2 1/2 cups
- 1 pound of iron sulfate (FeSO₄•7H₂O) ≈ 2/3 cup

COMPUTER COMMENTS FOR PH, LIME, SULFUR, TRACE ELEMENTS, CALCIUM, AND MAGNESIUM

- *601. The above lime recommendation is for adjusting the soil pH to 6.5. Omit lime application for acid-loving plants.
Use if: Crop Code is 250 (Potted House Plant) and Lime Rec is > 0.
- *602. Your sample information sheet was marked as this being an organic soil, having greater than 15% organic matter. Optimum soil pH for crops grown on organic soils is 5.2. While this pH level is dangerously low for mineral soils, crops grow well at this level on organic soils.
Use if: Soil is Organic (soil contains > 15% organic matter)
- *606. Soil pH is too low for good growth of forage crops. A pH of 5.5 to 6.0 is required.
Use if: Crop Code is 421 (Hay & Pasture Mixtures on Surface Mined Areas) and if pH <3.95.
- *607. LIME RECOMMENDATIONS: Apply _____ tons of agricultural lime per acre.
Use if: Lime Rec is > 0 and is reported in units of T/A and reported in the comment area.
- *608. LIME RECOMMENDATIONS: Apply _____ pounds of agricultural limestone (ground or pulverized) per 100 square feet.
Use if: LR (Lime Rec) is > 0, but ≤ 5, and LR is reported in units of lbs/100 sq ft.
- *609. LIME RECOMMENDATIONS: Apply _____ pounds of agricultural limestone (ground, pulverized or pelletized) per 1000 square feet.
Use if: LR (Lime Rec) is > 0, but ≤ 50, and LR is reported in units of lbs/1,000 sq ft.
- *610. LIME RECOMMENDATIONS: Apply _____ pounds of agricultural limestone (ground or pulverized) per 100 square feet. If lime is not going to be mixed into the soil, make several small applications of up to 5 lbs each, at intervals of 1 to 6 months, until the full amount is applied.
Use if: LR (Lime Rec) is > 5 and LR is reported in units of lbs/100 sq ft.
611. LIME RECOMMENDATIONS: Apply _____ pounds of agricultural limestone (ground or pulverized) per 1000 square feet. Disk or Rototill 6" deep into the soil. If it is not possible to incorporate the lime, make several small applications of up to 50 lbs each, at intervals of 1 to 6 months, until the full amount is applied.
Use if: Crop Code is 201 or 203 (Lawn Establishment), and Lime Rec is > 50.
612. LIME RECOMMENDATIONS: Apply _____ pounds of agricultural limestone (ground, pulverized or pelletized) per 1000 square feet in several small applications of up to 50 lbs each, at intervals of 1 to 6 months, until the full amount is applied.
Use if: Crop Code is 202 or 204 or 80, 81, 82, or 83, and Lime Rec is > 50.
(Lawn Maintenance or Golf Course Greens and Tees)
- *613. LIME RECOMMENDATIONS: Apply _____ teaspoons of agricultural limestone (ground or pulverized) per 5" pot.
Use if: Lime Rec is reported in units of Tsp/Pot and Lime Rec is > 0.
- *614. TYPE OF LIME TO APPLY: Apply dolomitic limestone which will supply needed magnesium in addition to correcting acidity.
Use if: Mg is L or L- (Low or Very Low), and Lime Rec > 0 is reported in the comment area.
- *615. TYPE OF LIME TO APPLY: Apply calcitic limestone which will supply needed calcium in addition to correcting acidity.
Use if: Ca is L+ or L or L- (any Low rating) and Mg is VH (Very High) and Lime Rec > 0 is reported in the comment area.

- *617. If this field has a history of black shank or black root rot, the severity of losses could be more severe with a soil pH above 6.5. However, a high soil pH does not indicate that a disease problem would be expected to occur. Consider using a resistant variety or choosing another field. Your local extension agent can provide assistance in this matter.
Use if: Crop Code is 16, 17 or 18 (tobacco, but not 15, flue-cured) and pH > 6.54.
- *619. Lime recommendations: NONE NEEDED.
Use if: Lime Rec is 0 and is reported in the comment area.
- *620. For best results, the lime should be applied six months to one year ahead of time.
Use if: Crop Code is 31 (Establishment of Tall Grass) and pH < 5.75 and lime is recommended.
- *630. Soil pH needs to be lower. So first, do NOT apply any liming material, including wood ashes. To help reduce the pH, do one of the following. OPTION #1 – Apply ___ pounds of aluminum sulfate per 100 square feet. OPTION #2 – Apply _____ of elemental (“free”/85-100% pure) sulfur (as a fine powder, called “flowers of sulfur”) per 100 square feet. Preferably, mix either one into the soil, and retest the soil after 4 to 6 months to determine if further applications are needed. Option #2 works slower, but is longer lasting, and safer, especially for blueberries. Option #1 works faster and is better for obtaining blue hydrangeas. Take care not to over apply either one to existing plants, and it is safest to apply no more than 5 pounds of aluminum sulfate per 100 square feet per month until the full amount has been applied.
Use to: lower the soil pH, when garden pH > 7.4 or when pH > 5.5 for acid-loving plant.
- *631. The pH of this sample is extremely low, probably due to the oxidation of pyrite minerals to sulfuric acid. No lime recommendation has been made; accurate recommendations for this acid sulfate soil must be based on an appropriate potential acidity test rather than pH. Please contact the Virginia Tech Extension Soil Testing Lab for a list of qualified laboratories for this test.
Use if: pH < 3.95.
- *632. If Sericea Lespedeza is to be used in the mixture, less lime may be required.
Use if: Lime Rec > 0 and Crop Code = 420, 421, 422 or 423 (surface mined areas establishment [seeding] of grasses and legumes).
- *635. No further crop response is expected when applying more than 2 to 3 T/A of lime in one application. Therefore, apply half of the total lime now, and the remainder in 6 to 12 months.
Use if: (Lime Rec > 3.25) and (Crop is a Field Crop or Forage Maintenance), but Crop Code is not from the Surfaced Minded Areas form.
- *640. Zinc, boron, and molybdenum are needed. For rates of application, see Note 4. Manganese may also be needed; apply if deficiency symptoms occur.
- *641. Boron and molybdenum are needed. For rates of application, see Note 4. Manganese may also be needed; apply if deficiency symptoms occur.
- *642. Zinc, boron, and molybdenum are needed. For rates of application, see Note 4.
- *643. Zinc and molybdenum are needed. For rates of application, see Note 4. Manganese may also be needed; apply if deficiency symptoms occur.

- *644. Zinc and boron are needed. For rates of application, see Note 4. Manganese may also be needed; apply if deficiency symptoms occur.
- *645. Boron and molybdenum are needed. For rates of application, see Note 4.
- *646. Molybdenum is needed. For rates of application, see Note 4. Manganese may also be needed; apply if deficiency symptoms occur.
- *647. Boron is needed. For rate of application, see Note 4. Manganese may also be needed; apply if deficiency symptoms occur.
- *648. Zinc and molybdenum are needed. For rates of application, see Note 4.
- *649. Zinc and boron are needed. For rates of application, see Note 4.
- *650. Zinc is needed. For rate of application, see Note 4. Manganese may also be needed; apply if deficiency symptoms occur.
- *651. Molybdenum is needed. For rate of application, see Note 4.
- *652. Boron is needed. For rate of application, see Note 4.
- *653. Manganese may be needed; apply if deficiency symptoms occur. See Note 4 for method of application.
- *654. Zinc is needed. For rate of application, see Note 4.
- *655. Zinc is needed for the small grain crop. See Note 4.
- *657. Manganese may be needed for the soybean crop. Apply if deficiency symptoms occur. See Note 4 for method of application.
- *659. Manganese may be needed. Apply if deficiency symptoms occur. See Note 4 for method of application.
- *660. Molybdenum is needed for the soybean crop. See Note 4.
- *661. Apply 30 lbs of magnesium (Mg) per acre to the soil using magnesium sulfate, sulfate of potash magnesia, or promesium. Magnesium can also be applied as a foliar spray using magnesium sulfate at the rate of 3-4 lbs of actual magnesium per acre.
- *662. Apply landplaster as follows: If U.S. Gypsum material is to be used, apply broadcast at 900 lbs per acre or banded over the row at 600 lbs per acre. If Texas Gulf material is to be used, apply broadcast at 1500 lbs per acre.
- *681. Boron is needed. See Note 4. Manganese may also be needed; apply if deficiency symptoms occur, using rates in Note 4.
- *682. Boron is needed. See Note 4.
- *683. Manganese may be needed. Apply if deficiency symptoms occur, using rates in peanut production guide.

*705. On very sandy soils (sands, loamy sands) where the clay layer is more than 20 inches below the surface, apply 30 lbs of sulfur per acre. NOTE - on heavier soils (sandy loams, loams) or sands where the clay layer is less than 20 inches from the surface, no response to sulfur is expected.

Use if: Crop Code is corn (1, 2, 3, 4 or 20) or soybeans (10) or hops (175) in a Coastal Plain county.

*706. On very sandy soils (sands, loamy sands) where the clay layer is more than 20 inches below the surface, apply 30 lbs of sulfur per acre to the soybean crop. The sulfur can be applied when the small grain crop is topdressed or just prior to planting the soybeans. NOTE - on heavier soils (sandy loams, loams) or sands where the clay layer is less than 20 inches from the surface, no response to sulfur is expected.

Use if: Crop Code is 11, small grain - soybean double crop rotation, in a Coastal Plain county.