



AGRONOMY AND SOILS DEPARTMENTAL SERIES NO. 178

MAY 1994

ALABAMA AGRICULTURAL EXPERIMENT STATION

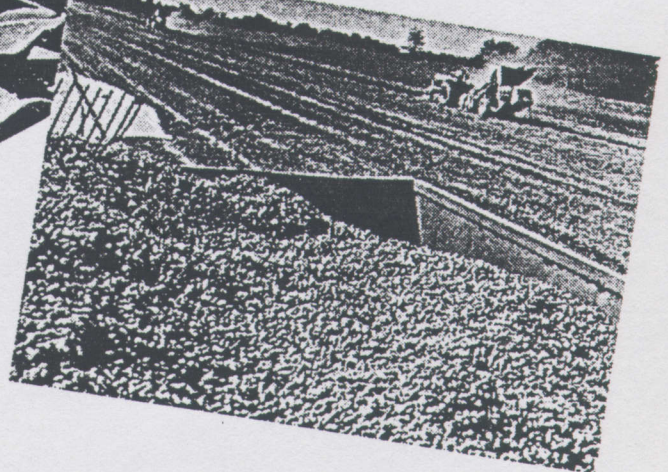
LOWELL T. FROBISH, DIRECTOR

AUBURN UNIVERSITY

AUBURN UNIVERSITY, ALABAMA



# SOIL TEST FERTILIZER RECOMMENDATIONS FOR ALABAMA CROPS





## CONTENTS

	<i>Page</i>
Introduction .....	5
Soil Testing Process .....	6
Elements Required for Growing Plants .....	8
Macronutrients .....	9
Primary Nutrients .....	9
Secondary Nutrients .....	11
Micronutrients .....	12
Soil Testing Service .....	15
Definitions of Soil-Test Ratings Used for P and K .....	18
Descriptions of Soil Groups on Which P and K Soil-Test Ratings are Based .....	19
Extractable Nutrients in Pounds Per Acre .....	23
Table Versus Formulas .....	23
Lime Recommendations .....	24
Lowering Soil pH .....	26
Magnesium Recommendations .....	26
Soil Organic Matter .....	28
Fertilizer Recommendation .....	29
Yield Potential (Yield Goal) .....	30
Interpreting Report of Soil Tests (sample copy) .....	31
Report on Soil Tests (sample copy) .....	32
Recommendations for Field Crops, Forage Crops, and Pastures .....	33
Recommendations for Turfgrass, Lawns, Golf Courses, Athletic Fields, and Roadsides ..	45
Recommendations for Gardens and Commercial Vegetable Crops .....	51
Recommendations for Shrubs and Flowers .....	57
Recommendations for Fruits and Nuts .....	61
Research .....	67
Equations .....	68

*Information contained herein is available to all persons  
without regard to race, color, sex, or national origin.*



# SOIL TEST FERTILIZER RECOMMENDATIONS

## FOR ALABAMA CROPS

J.F. Adams, C.C. Mitchell, and H.H. Bryant<sup>1</sup>

### INTRODUCTION

Most soils in Alabama must be fertilized for optimum production. Unfertilized soils are naturally low in plant nutrients because the parent materials from which they were formed were low in phosphorus (P), and many were low or medium in potassium (K). In addition, Alabama's relatively high temperatures plus rainfall have caused release, leaching, and runoff of nutrients from fields, especially where they have been cropped continuously and the surface has been allowed to erode. Likewise, the nitrogen (N) supplying capacity of soils is dependent on the organic matter content which is low in Alabama soils because of rapid decomposition under prevailing environmental conditions. Therefore, unless these major nutrients have been built up in soils by past fertilization and management practices, soils will need fertilizer for sustainable production.

Most Alabama soils have been in continuous production for more than 150 years. Some have been fertilized regularly throughout that period. The addition of nutrients to soils and crops where they are not needed and cannot be utilized is a waste of resources and could also be environmentally unsound.

Nutrient needs were originally determined by thousands of simple fertilizer experiments conducted on farms throughout the state. Prior to the establishment of the Auburn University Soil Testing Laboratory in 1953, general fertilizer recommendations were made by Auburn University for different soil types. These recommendations were based on

---

<sup>1</sup>Respectively, Associate Professors and Senior Research Associate of Agronomy and Soils.

these cooperative experiments and other more detailed experiments conducted on substations and experiment fields located on the major soils throughout the state.

This system is no longer adequate because soils have been altered by past management. Properly managed soils have become more productive during the past 40 years as fertilizer use has increased. Some nutrients may have been depleted while others have been built up in soils, depending on amounts supplied in fertilizers and manures and amounts removed in harvested crops and forages. General fertilizer recommendations based on soil type are no longer practical because past management practices now have more influence on soil fertility than does soil type. Soils separated only by a fence may differ more in fertility than the original unfertilized soils located in the different regions of the state.

Soil tests have been developed to determine the fertility level of individual soils. This has required much field and laboratory research at many locations over the years to calibrate test results with response to fertilizers in the field. Reliable soil tests based on such research are now the only practical basis for determining the needs of specific crops on the many soil situations now existing in Alabama.

## SOIL TESTING PROCESS

Soil testing involves more than just a chemical analysis. For the results to be meaningful to a grower, four steps must receive careful attention.

### Step 1 - Taking a good sample

Recommendations based on a soil test can be no better than the soil sample from which they are made. Growers are urged to take great care to be sure that the sample submitted represents as accurately as possible the area from which it is taken. Generally a sample should be a composite of subsamples taken from 10 to 20 spots in the area. Samples

from plowed fields should be taken to plow depth, while those from sod or areas not to be plowed should be taken to a depth of two to three inches.

#### Step 2 - Analyzing the sample

This is the chemical extraction and testing procedure used by the laboratory. Although laboratories may use different extraction and analysis techniques, the procedures used must be correlated to plant growth and nutrient uptake in Alabama. In addition, quality control by the staff is essential for reliable and accurate results. The Auburn University Soil Testing Laboratory uses procedures recommended and published by the Southern Extension and Research Activity on Soil Testing and Plant Analysis Information Exchange Group (SERA-IEG-6).

#### Step 3 - Interpreting the analysis

The analytical results must be related to plant growth or yield. Extensive soil test calibration research on the crops and soils of Alabama has been conducted and will continue. For each nutrient, crop, and soil, a good calibration must show that plant growth, yield, or nutrient uptake increases as the level of an extractable nutrient increases up to a point where further increases in soil test levels fail to show significant or economical increases of plant growth or yield.

#### Step 4 - Using the results

When growers receive a soil test report and appropriate recommendations, they must make certain practical decisions that may result in a modification of the given recommendation. Some of these decisions may involve the following:

1. Using readily available fertilizers or ordering custom blended fertilizer.
2. Applying the same fertilizer grade to all fields or groups of fields, or ordering separate fertilizers for each field (or portion of a field) sampled.

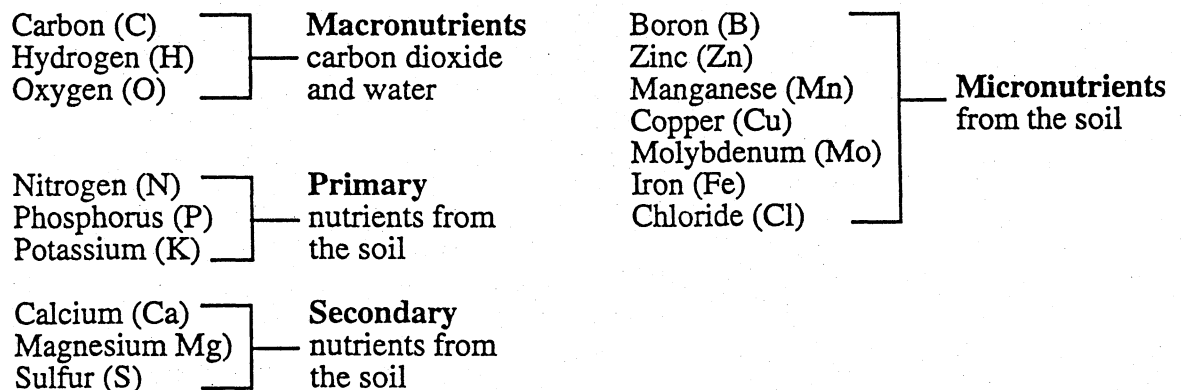
3. Using premium fertilizers that contain secondary nutrients and micronutrients or applying only those micronutrients specifically recommended for the crop.
4. Splitting fertilizer and/or lime applications.
5. Using starter fertilizers and foliar fertilizers to supplement recommendations.
6. Modifying nitrogen recommendations based upon comments in the report.
7. Applying fertilizers with other materials, such as herbicides.
8. Modifying recommendations based upon current economic conditions.

These and many other considerations affect how the soil test results are used, and is a decision the grower or crop advisor must make.

Auburn University's soil testing program is a joint program of the Alabama Cooperative Extension Service and the Alabama Agricultural Experiment Station. The Cooperative Extension Service has primary responsibility for education on soil testing and distribution of supplies. The Agricultural Experiment Station conducts soil test calibration research and operates the Soil Testing Laboratory.

### ELEMENTS REQUIRED FOR GROWING PLANTS

Only 16 elements are known to be required for plant growth. These nutrient elements can be divided into four groups:





These nutrient elements are discussed briefly to provide background for a better understanding of the information on fertilization and plant nutrition that follows.

### **Macronutrients**

The nutrient elements C, H, and O are obtained by plants from air ( $\text{CO}_2$ ) and water ( $\text{H}_2\text{O}$ ) in sufficient amounts to support maximum growth. There is no need for concern about supplying these elements in fertilizers.

### **Primary Nutrients**

The elements N, P, and K constitute about 3 to 5% of the dry weight of most plants and are the most frequently deficient nutrients in Alabama soils. Accordingly, these are the nutrients in fertilizers most frequently and abundantly applied.

**Nitrogen** is the nutrient that is most frequently limiting crop production and is needed in greatest quantities for most nonlegume crops. Soil tests are not reliable for determining the nitrogen supplying capacity of individual soils in the Southeast. There are several reasons for this. First, nitrogen is stored in the soil's organic matter. The rate of N release for crop use is affected by organic matter content, temperature, moisture, length of growing season, and other factors that make it impractical to predict the amount of N that will be supplied by the soil for a growing crop. Second, Alabama soils are low in organic matter and do not vary much in their capacity to supply nitrogen. Therefore, nitrogen recommendations are based primarily on the crop to be grown.

The most economical rates of application have been determined in numerous field experiments. The amounts recommended should be adjusted by growers based on experience with previously used rates. Nitrogen supply is the dominant fertility factor in determining rate

and amount of growth of most crops. Legume crops get most of the N required for their growth from the air, which contains about 80% N.

Phosphorus content of practically all Alabama soils originally was low. Fertilizers used in the early days of fertilization were much higher in P than in N or K. Fortunately, P does not leach through soils but forms compounds with other elements in the soil and is released slowly. However, P is lost from fields where the surface soil is allowed to erode. Also, phosphorus in the plow layer may become diluted when turning the land deeper than normal.

Crops require much smaller quantities of P than of N and K. Usually plants contain about 0.2 to 0.3% P. Therefore, under continuous fertilization, soil content of P has increased on many soils to High, Very High, and Extremely High levels. About 50% of all samples received by the Soil Testing Laboratory in recent years have been High in P, and crops grown on those soils would not be expected to respond to P applications. Experiments at several substations and experiment fields have shown that where P has been built up to High or Very High levels, lack of P application will not reduce yield of most crops for up to 40 years or more. Therefore, on soil test reports for field and forage crops, none is recommended when P is in the High range; but growers should sample each year where none is applied to avoid yield losses should soil P drop back into the Medium range where some response could be anticipated.

**Potassium.** As yields have been increased by higher N and P fertilization, the need for K on some soils has increased. Most of the sandy soils of Alabama are low to medium in K, while the clays and clay loams are more likely to be high. Response to K has been determined in numerous experiments throughout the state. Excessive use of K may cause Mg deficiency, especially on sandy soils. Recent residual studies have shown that K may accumulate in most soils where recommended rates are applied. When soil tests indicate that

this accumulation has reached the **High** level, growers may reduce or cease applications until the soil level drops back into the **Medium** range.

### **Secondary Nutrients**

The elements calcium (Ca), magnesium (Mg), and sulfur(S) are classified as secondary nutrients for plant nutrition. Some Alabama soils and crops should be supplied with these nutrients.

**Calcium** is supplied in both calcitic and dolomitic lime. Where soil pH is maintained in the proper range, calcium deficiency is not likely to occur. Peanuts, tomatoes, and peppers are the only crops that have been found to suffer from lack of calcium in Alabama fields. This deficiency may result in unfilled pods (pops) in peanuts and blossom end rot in tomatoes and peppers. All samples are analyzed for calcium in the Soil Testing Laboratory. When the tests indicate that deficiencies may occur on these crops, gypsum may be recommended if lime is not needed.

**Magnesium (Mg)** content of all soil samples is also determined. Some sandy soils in Alabama are deficient in Mg and these soils are usually low in pH. The most practical way to prevent Mg deficiency is by using dolomitic lime when soil tests indicate that Mg is **Low**. On soils where Mg is not found to be deficient, calcitic or dolomitic lime is satisfactory.

**Sulfur (S)** deficiency has increased as high analysis fertilizers made from ammonium phosphates have replaced fertilizers made from superphosphate, which contains about 12% S. Sulfur added to soils in rain has decreased in areas where effluent from industrial plants has been scrubbed to reduce air pollution.

Sandy soils of the coastal plains and sandstone plateaus are most likely to be deficient in S, because this element may be leached from sandy surface soils. There is no practical soil

test procedure to use in predicting S deficiency. Like N, it is found mostly in organic matter in sandy topsoils. It frequently accumulates in the subsoil and plants may recover from the deficiency when roots reach the subsoil.

All crops should receive an average of about 10 pounds of S per acre per year, applied in fertilizer or in pesticide applications. Crops most likely to respond to S fertilization on sandy soils are wheat, corn, cotton, and vegetable crops. Farmers should always check when buying mixed fertilizer to be certain that it contains enough S to supply this amount.

### **Micronutrients**

Although the seven micronutrients are as important in plant nutrition as the primary and secondary nutrients, they are needed in much smaller quantities, and most Alabama soils contain adequate amounts for most crops. The Agricultural Experiment Station has conducted field, greenhouse, and laboratory research continuously since about 1930 on the response of crops to micronutrient elements. Field experiments with boron, zinc, manganese, copper, iron, and molybdenum have been conducted with various crops on the substations, experiment fields, and on farmers' fields throughout the state. Whereas some crops may use between 20 and 200 pounds per acre each of N, P, K, Ca, Mg, and S, they use less than one pound per acre of the micronutrients. Most Alabama soils have an abundance of minerals containing micronutrients. In some cases, over application of micronutrients, such as Zn, Cu, and B could lead to a toxicity. Metals, such as Zn and Cu, build up in the soil. These also may be found in certain pesticides. Soil test for Zn and Cu may be more valuable for avoiding toxic buildup than for predicting deficiencies.

Research with field and forage crops has shown that most deficiencies of micronutrients are limited to boron and zinc for a few crops on certain soils. The most

practical recommendation for these nutrients is to apply them to specific crops in all cases or on soils where they tend to be low. This eliminates the need for soil tests that are, in most cases, expensive and not always dependable enough to serve as a basis for recommendations. Although some soil testing laboratories determine micronutrient levels in the soil and make specific recommendations, their interpretations are not based on research for Alabama soils.

A chemical analysis or soil test is of little or no value unless calibrated against crop responses to applications of the nutrient in question. Such information can only be obtained from fertility experiments conducted under a wide range of soil and climatic conditions. The following is a brief description of the Auburn Soil Testing Laboratory's recommendations for the micronutrient elements.

**Boron (B)** is recommended for cotton, peanuts, clovers grown for seed, alfalfa, cauliflower, broccoli, root crops, apples, pears, and plums. Analysis for B is expensive and the cost of applying recommended rates is quite low; therefore, recommendations based on needs of specific crops are more practical than routine soil analyses.

**Zinc (Zn)** is recommended for corn on sandy soils where the pH is above 6.0 or for the first year after applying lime. It also is recommended for peaches, pecans, apples, and pears. These are the only crops that have responded to Zn on Alabama soils. Zinc deficiency in corn seedlings is likely to occur in cool, wet seasons. Corn plants usually recover when warm weather arrives, but yield may be decreased by the early deficiency. Routine analysis for Zn is not necessary in most cases, but soil and plant analysis for Zn may be helpful in diagnosing suspected cases of deficiency or toxicity. Simultaneous applications of excessive amounts of both lime and phosphorus can induce Zn deficiency on almost any crop. Soil tests showing pH values above 7.0 along with **Very High** or **Extremely High P** indicate a probability that Zn deficiency may occur on some soils.

Zinc toxicities could occur on sensitive crops, such as peanuts, where excessive Zn application have caused high soil Zn levels (more than 10 mg/kg extractable Zn) on sandy soils. Maintaining a soil pH above 6.0 may help to reduce Zn toxicity symptoms.

Broiler litter, certain pesticides, and some industrial by-products used as soil amendments may contain high concentrations of Zn.

Iron (Fe) is a common deficiency for only a few crops (e.g. soybeans) on the high pH soils of the Black Belt and for some specialty plants (e.g. azaleas, centipedegrass, and blueberries) where lime or phosphorus is excessive. This deficiency cannot be corrected by application of Fe to the soil, but can be corrected on ornamental and fruit crops by spraying with a dilute iron solution. Soil analysis for Fe is worthless. Some soybean varieties are less susceptible than others to Fe deficiency. Varieties rated for susceptibility to Fe deficiency can be found in soybean variety reports.

Molybdenum (Mo) application to soybeans as a foliar or seed treatment at planting is recommended for all soils of North Alabama and for Black Belt soils. Deficiency of Mo on soybeans on acid soils can usually be prevented by liming. Because Mo is needed in such small quantities, soil testing is not recommended.

Manganese (Mn) is high in almost all Alabama soils and is not recommended for any crop. Soybeans grown on sands with poor internal drainage, high organic content, and a pH above 6.0 may show Mn deficiency. Symptoms of cyst nematode damage are very similar to those for Mn deficiency on soybeans.

Copper (Cu) and Chlorine (Cl) have not been found to be deficient for any crop on Alabama soils. There is no need to supply these elements in fertilizers in Alabama. Excessive Cu may be applied to soil in broiler litter and certain Cu-containing pesticides.

## Present Policy on Micronutrients

Due to the previously described points, the laboratory does not analyze soil samples for S, Mn, Cu, Cl, Fe, or Mo. If and when research shows that analysis for one or more of these elements is justified, this service will be provided.

Under certain conditions, a soil test for B and Zn may be helpful in diagnosing problems. Therefore, samples will be analyzed on request for B and for Zn at an extra charge. Soil test reports may be delayed for several days when these elements are being analyzed.

## SOIL TESTING SERVICE

This publication presents the fertilizer recommendations made by the Auburn University Soil Testing Laboratory. The information is organized for the computer program that is used to make recommendations on samples analyzed by this laboratory. Crops are divided into more than 50 classes, about one-half of which are field and forage crops and one-half are horticultural or specialty crops. The crops are listed in Table 1 with a summary of information used in classifying crops based on fertility requirements, and in making recommendations for each crop. Detailed instructions and recommendations are presented in individual tables for each crop on pages 33 through 67. These tables contain the following information:

1. **Crop code number** and a list of the crops included in this code number.
2. **K requirement level number.** Crops are divided into three classes based on their K requirements. These classes are (1) peanuts, (2) soybeans and corn and other grasses; and (3) cotton, forage legumes, gardens, lawns, shrubs, and other special crops. They are

presented in Table 2 along with the pounds per acre of soil test P and K used to rate the different soil groups from **Very Low** to **Extremely High**.

3. **N rate.** Each crop is assigned a standard, annual N rate based upon research conducted throughout Alabama. However, comments given with each crop may modify this rate based upon potential yield, soil, time of application, cropping system, etc.

4. **Lime recommendation code number.** Crops vary in the amount of acidity they can tolerate and still make top yields. They are divided into five classes based on the pH ranges in which they produce best. These classes are presented in Table 5 and on the pages that provide fertilizer recommendations for each crop.

5. **Mg recommendation code number.** Crops are divided into three classes based on their Mg requirements. These Mg recommendations are from Table 8.

Specific comments that go with individual recommendations or crops are listed by number with the fertilizer recommendations. Comments used with each crop also are presented with fertilizer recommendations for each crop.



Table 1. Crop Classes and Computer Code Numbers Used in Recommendations

Crop code no.	Crop	K re-quire-ment level	N rate	Lime code	Mg code	Page no.
<b>Field Crops, Forage Crops, and Pastures</b>						
01	Perennial summer grass pasture.....	2	60	5	1	33
02	Bermuda hay (improved varieties) .....	2	100	5	1	33
03	Perennial winter grass pasture .....	2	60	1	1	34
04	Temporary summer grass pasture and johnsongrass .....	2	60	1	1	34
05	Annual legume with small grain and ryegrass ....	3	60	1	1	35
06	White clover, arrowleaf clover, red clover .....	3	0	2	1	35
07	Perennial or late-maturing annual legumes with summer grass pasture.....	3	0	2	1	36
08	Clover and winter perennial grass pasture .....	3	0	2	1	36
09	Annual legume and summer grass pasture .....	3	0	1	1	37
10	Cotton .....	3	90	1	2	37
13	Corn .....	2	120	1	1	38
15	Corn in rotation before soybeans .....	2	120	1	1	38
16	Irrigated corn, corn, or sorghum silage .....	2	180	1	1	39
17	Peanuts .....	1	0	1	1	40
19	Annual legumes .....	3	0	1	1	40
20	Southern peas .....	3	30	1	1	41
21	Grain sorghum, sweet sorghum, sugarcane, and sunflower .....	2	80	1	1	41
22	Alfalfa .....	3	0	3	1	42
23	Sericea .....	3	0	1	1	42
24	Soybeans .....	2	0	1	1	43
25	Small grain-soybean rotation .....	2	100	1	1	43
26	Tobacco .....	3	60	4	3	44
27	Small grain or temporary winter grass pasture ....	2	100	1	1	44
<b>Lawns, Golf Courses, Athletic Fields, and Roadsides</b>						
40	Bermuda, Zoysia, St. Augustine lawn .....	3	80	5	1	45
42	Centipede lawn .....	3	40	5	1	46
43	Winter lawn .....	3	80	5	1	47
44	Golf green .....	3	400	1	1	48
45	Golf fairway .....	3	120	5	1	49
46	Athletic field .....	3	200	5	1	49
47	Roadside turf establishment .....	3	120	1	1	50
48	Roadside turf maintenance .....	3	80	1	1	50
<b>Gardens and Commercial Vegetable Crops</b>						
59	Organic vegetable garden .....	-	-	-	-	51
60	Home vegetable garden .....	3	120	1	2	51
61	Commercial vegetable crops .....	3	120	1	2	53
62	Tomatoes .....	3	120	2	2	53

Continued

Table 1 (Continued). Crop Classes and Computer Code Numbers Used in Recommendations

Crop code no.	Crop	K requirement level	N rate	Lime code	Mg code	Page no.
63	Sweet potatoes .....	3	80	1	2	54
64	Irish potatoes .....	3	120	4	3	54
65	Watermelons, cantaloupes, cucumbers, lima beans, snap bunch beans, squash, and okra .....	3	80	1	2	55
66	Sweet corn .....	3	150	1	2	55
67	Pepper, pimiento .....	3	100	2	2	56
<b>Shrubs and Flowers</b>						
80	Shrubs and perennial flowers .....	3	120	1	2	57
81	Azaleas, gardenias, and rhododendrons .....	3	120	0	2	58
82	Roses, mums, and annual flowers .....	3	120	1	2	59
84	Potting soil (84 reports lb./acre P, K, Ca, and Mg; soluble salts, nitrates, pH) .....					60
85	Christmas trees .....	2	*	4	3	60
<b>Fruits and Nuts</b>						
89	Strawberries .....	3	120	1	2	61
90	Peaches .....	2	*	2	2	62
91	Muscadine grapes .....	2	*	2	2	63
92	Apples and pears .....	2	*	2	2	63
93	Plums .....	2	*	2	2	64
94	Pecans .....	2	*	2	2	65
95	Home orchards .....	3	*	2	2	65
96	Blueberries .....	3	*	0	3	66
<b>Research</b>						
98	Checks and balances .....					67
99	Computer reports pounds per acre of soil-test P, K, Ca, and Mg .....					67

\* Standard N recommendation in pounds per acre. See comments for modifications.

#### Definitions of Soil-Test Ratings Used for P and K

Results of chemical tests are used to rate the fertility level of soils for each nutrient element tested. The ratings range from very low to extremely high. They are influenced by the soil and the nutrient requirements of the crop to be grown. The ratings for P and K are based on the relative

yield that may be expected without adding the nutrient and when all other elements are in adequate supply. Fertilizer recommendations are based on these ratings, see the figure.

**Very Low (VL)** - Soil will yield less than 50% of its potential. Large applications for soil building purposes are usually recommended. Some of the fertilizer should be placed in the drill for row crops.

**Low (L)** - Soil will yield 50 to 75% of its potential. Some fertilizer should be placed in the drill for row crops.

**Medium (M)** - Soil will yield 75 to 100% of its potential. Continued annual applications should be made in this range. On some sandy soils that will not retain much K, it may not be economical to attempt to build beyond this medium level.

**High (H)** - Supply of the nutrient is adequate for the crop, and none is recommended for field and forage crops. Where this recommendation is followed, it is suggested that the area be sampled each year.

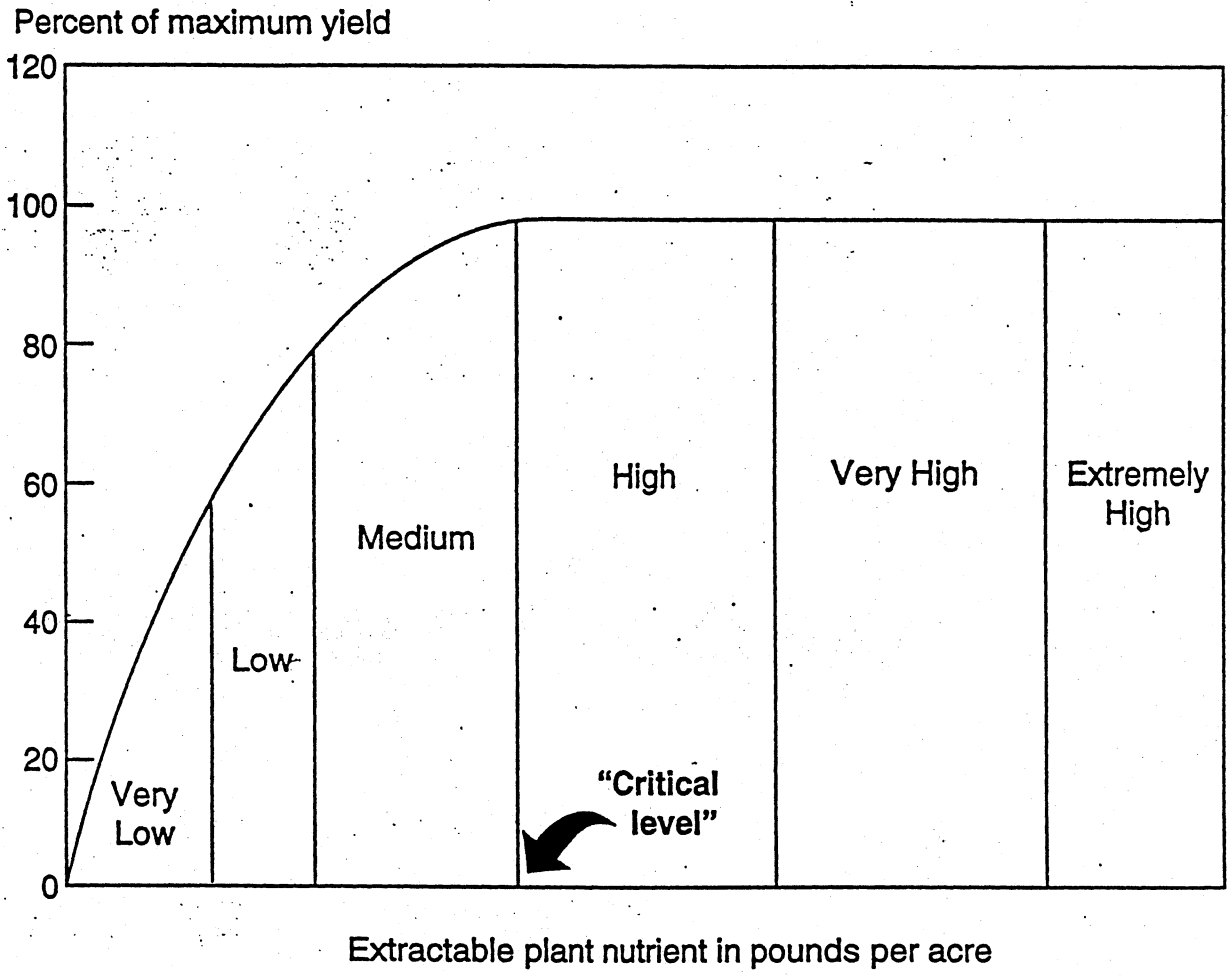
**Very High (VH)** - Supply of the nutrient is more than double the amount considered adequate. Application of P or K to soils of this rating is wasteful.

**Extremely High (EH)** - Supply of the nutrient is more than four times the amount considered adequate. The level is excessive and further additions may be detrimental to the crop and may contribute to pollution of ground and surface waters.

Pounds per acre of soil test P, K, Ca, and Mg on which soil-test ratings are based for the different crops and soil groups are presented in tables 2 and 3.

#### **Descriptions of Soil Groups on Which P and K Soil-Test Ratings are Based**

Availability of nutrients in soils to plants is affected by the amount in the soil, cation exchange capacity (CEC) of the soil, and other factors. The amount in the soil is determined by the



Relationship between extractable plant nutrient and soil test rating.

parent material from which the soil is formed; the amount that has been added in fertilizers, liming materials or organic wastes; the amount of organic matter; and the amount that has been removed by cropping, erosion, and leaching. The CEC is a measure of the capacity of the soil to retain nutrients against removal by crops, erosion, or leaching. It is affected by organic matter content and the amount and type of clay in the soil. Therefore, knowing the CEC of individual soil samples is important before making fertilizer recommendations. This is determined in the Soil Testing Laboratory and serves as the basis for classifying soils into four groups.

**Soil Group 1.** Sandy soils with cation exchange capacities less than  $4.6 \text{ cmol}_c \text{ kg}^{-1}$  of soil. Examples of soils in this group are Dothan, Orangeburg, Alaga, Bama, and Troup.

**Soil Group 2.** Loamy and clayey soils with cation exchange capacities of  $4.6$  to  $9.0 \text{ cmol}_c \text{ kg}^{-1}$  of soil. Examples of soils in this group are Madison, Lucedale, Allen, Hartsells, Cecil, Pacolet, Dickson, and Savannah.

**Soil Group 3.** Clayey soils, from areas other than the Black Belt, with cation exchange capacities of more than  $9 \text{ cmol}_c \text{ kg}^{-1}$  of soil. Colbert, Decatur, Dewey, Talbott, Boswell, and Iredell are examples of soils from this group. Garden soils that have had large amounts of organic amendments may also be in this group.

**Soil Group 4.** Acid and calcareous clayey soils of the Black Belt with cation exchange capacities greater than  $9.0 \text{ cmol}_c \text{ kg}^{-1}$  of soil. These soils require different laboratory procedures for measuring soil fertility. Examples of soils in this group are Sumter, Oktibbeha, Leeper, and Vaiden.

The group in which a soil is classified may affect the fertility ratings and therefore the P and K recommendations. Growers sometimes do not understand why samples from individual fields change groups between samplings. When a soil is near the borderline between groups, (e.g.  $4.6 \text{ cmol}_c \text{ kg}^{-1}$ ) it may fall into one soil group this year and the other group the following year. Liming the soil also may cause it to be shifted from Group 1 to Group 2 or from Group 2 to Group 3. Although CEC is determined on all samples, it is not recorded on soil test reports. Growers wishing more information about these relationships on their samples should contact the Soil Testing Laboratory.

Table 2. Soil-Test Ratings and Pounds Per Acre of Soil-Test P and K for All Soils and Crops

		Phosphorus					Potassium				
Rating (other crops)	Peanuts	Soil-test P			K req. level 3 cotton, legumes, gardens, lawns, and shrubs	K req. level 2 soybeans, corn, and other grasses	K req. level 1 Peanuts	Soil-test K			
		Soil 1,2 CEC 0-9	Soil 3 CEC>9	Soil 4* CEC>9				Soil 1 CEC 0-4.6	Soil 2 CEC 4.6-9.0	Soil 3 CEC>9.0	Soil 4* CEC>9.0
		Lb./a.	Lb./a.	Lb./a.			Lb./a.	Lb./a.	Lb./a.	Lb./a.	
V low	V low	0	0	0-3	V low	V low	V low	0-20	0-30	0-40	
V low	V low	1-2	1	4-6	V low	Low	Low	21-22	31-33	41-44	51-56
V low	V low	3-4	2	7-9	V low	Low	Low	23-24	34-36	45-48	57-62
V low	Low	5-7	3	10-12	V low	Low	Low	25-26	37-39	49-52	63-68
V low	Low	8-10	4-5	13-15	V low	Low	Low	27-28	40-42	53-57	69-74
V low	Medium	11-12	6-7	16-18	V low	Low	Medium	29-30	43-45	58-60	75-80
Low	Medium	13-19	8-11	19-27	Low	Low	Medium	31-40	46-60	61-80	81-120
Low	High	20-25	12-15	28-36	Low	Medium	High	41-60	61-90	81-120	121-160
Medium	High	26-34	16-21	37-48	Medium	Medium	High	61-80	91-160	121-160	161-190
Medium	High	35-43	22-26	46-60	Medium	High	High	81-100	121-150	161-200	191-220
Medium	High	44-50	27-30	61-72	Medium	High	V high	101-120	151-180	221-240	221-240
High	V high	51-65	31-40	73-94	High	High	V high	121-160	181-240	241-320	241-320
High	V high	66-100	41-60	95-144	High	V high	V high	161-240	241-360	321-480	321-480
V high	V high	101-135	61-81	45-195	V high	V high	V high	241-320	361-480	481-640	481-640
V high	V high	136-200	82-120	196-288	V high	E high	E high	341-480	481-720	641-960	641-960
E high	E high	201+	121+	289*	E high	E high	E high	481+	721+	961+	961+

\*Group 4 soils are from Black Belt counties and are extracted with the Mississippi extract. All others are extracted with Mehlich 1.

Table 3. Soil-Test Ratings and Pounds Per Acre of Soil-Test Mg and Ca for Soils and Crops

Rating	Magnesium (all crops)		Rating	Calcium (all soils)	
	Soil-test Mg			Peanuts	Tomatoes, pimientos, fruits, and nuts
	Soil 1 CEC 0-4.6	Other soils CEC >4.6			
Low .....	0	0	Low	0	0
Low .....	1-2	1-5	Low	1-2	1-40
Low .....	3-5	6-10	Low	25-50	41-80
Low .....	6-7	11-15	Low	51-75	81-120
Low .....	8-10	16-20	Low	76-100	121-160
Low .....	11-12	21-25	Low	101-125	161-200
Low .....	13-15	26-30	Low	126-150	201-250
Low .....	16-17	31-35	Low	151-175	251-300
Low .....	18-20	36-40	Medium	176-215	301-365
Low .....	21-22	41-45	Medium	216-255	366-430
Low .....	23-25	46-50	Medium	256-300	431-500
High .....	26-33	51-65	High	301-390	501-650
High .....	34-50	66-100	High	391-600	651-1,000
High .....	51-100	101-200	High	601-1,200	1,001-2,000
High .....	101-200	201-400	High	1,200-2,400	2,001-4,000
High .....	201+	401+	High	2,401+	4,001+

#### Extractable Nutrients in Pounds Per Acre

All results are expressed in pounds per acre of an extractable nutrient. This method makes the assumption that an acre-furrow-slice (one acre of soil to a depth of eight inches) weighs two million pounds. Thus, pounds per acre is equal to pounds per two million pounds (pp2m) or mg per two kg.

#### Tables Versus Formulas

Fertilizer recommendations are given in table format or by formulas. The formulas with each recommendation table may allow for smaller incremental increases or decreases in fertilizer rates as compared to those rates presented in the tables. For example, if a soil test report shows 50 pounds

per acre of K and the producer wishes to use the formula to calculate K fertilizer needs; the following steps should be used:

1. Determine CEC range by looking at the soil group on the report;
2. Look up the appropriate equation in the back of this publication (page 68).
3. Substitute the pounds per acre of K for X and then solve for Y.

#### Example calculation

1. Corn
2. 50 pounds per acre soil test potassium
3. Soil group 1 (CEC 0-4.6)
4. Equation  $Y=80-0.99X$

$$Y=80-0.99(50)$$

$$Y=80-49.5$$

$$Y=30.5 \text{ lb K}_2\text{O per acre}$$

5. Round off to nearest 10 pounds.

The formula will allow for lower fertilizer rates when soil test levels are approaching a higher fertility rating.

#### Lime Recommendations

Practically all Alabama soils, except for the calcareous soils of the Black Belt, are slightly to strongly acid and may need to be limed for most crops. This acid condition results from the low level of lime in the original soils, the high rate of leaching from excessive rainfall, the use of acid forming fertilizers, crop removal, and other factors. About one-half of the samples received in the Soil Testing Laboratory need lime. This ratio has not changed much in recent years. Growers should use soil-test recommendations to maintain soil pH between 5.8 and 6.5 for most crops. Soil testing is the only practical basis for determining when and how much lime should be applied. Soil pH is a critical factor in determining response of crops to fertilizers and maintaining a favorable soil environment for



profitable production. Soil should be sampled every two or three years to ensure that production is not limited by soil acidity.

Lime recommendations are based on two separate tests made in the Soil Testing Laboratory on each sample. These are the (1) determination of pH, which indicates the active acidity of the soil, and the (2) lime requirement test, which determines the amount of lime required to raise the pH to a desired range. The amount of lime required varies among soils at the same pH because of differences in organic matter content and the kind and amount of clay in the soils. Soils that are high in organic matter and clay content require more lime to raise the pH to a specific range than do sandy soils that are low in organic matter. For example, a sandy soil at pH 5.0 may require only one ton of lime to raise the pH to 6.5, while a clay soil at the same pH may require four tons of lime.

Crops also have different requirements for soil pH, and therefore lime recommendations vary with the crop to be grown. Lime is recommended to correct the pH of the top eight inches of soil. Growers who plow deeper than eight inches should increase the rates accordingly. Lime should be thoroughly mixed with the soil because the primary reason for applying lime in most cases is to adjust the soil pH rather than to supply plant nutrients, such as Ca and Mg. Lime should be applied and mixed with the soil as soon after sampling as possible. It will begin to react with the soil immediately after application, but the full effect may not be evident for several months. Fineness and purity of lime are important in determining the rate of reaction. Lime recommendations are based on the minimum quality ground agricultural limestone as defined by the Alabama Department of Agriculture and Industries:

90%  $\text{CaCO}_3$  equivalent,

90% passes a 10 mesh sieve, and

50% passes a 60 mesh sieve.

The pH requirements on which lime recommendations for different crops are based are presented in Table 4.

Table 4. Lime Recommendation Codes

Code	Lime if below	Lime to	Crops
	pH	pH	
0 .....	Lime recommended only under special conditions		Blueberries
1* .....	5.8	6.5	All except those listed below
2 .....	6.0	6.5	Most clovers, gardens, vegetable crops, and most fruits and nuts
3 .....	6.5	7.0	Alfalfa
4 .....	5.0	5.5	Irish potatoes, azaleas, and tobacco
5 .....	5.6	6.5	Coastal bermudagrass, common bermudagrass, bahiagrass, dallisgrass, lawns, fairways, and athletic fields

\*Code 1 crops are moved to Code 5 when grown on fine textured soils of Soil Group 3 or 4.

### Lowering Soil pH

Most plants grow best where the soil is slightly acid in the range of pH 6.0 to 7.0. However, a few plants, such as azaleas, gardenias, and blueberries, grow best at lower pH values. In rare cases, it may be desirable to lower the pH by adding an acidifying agent. This can be done successfully on soils that do not contain large amounts of free lime. Calcareous Black Belt soils cannot be practically acidified because much of the soil contains lime ( $\text{CaCO}_3$ ). In other cases, the pH can be lowered simply by using fertilizers containing ammonium-N (Table 5). Ammonium sulfate and sulfur coated urea are two of the best choices for acidifying soils.

Amounts of sulfur needed to lower the pH of loamy soils are indicated in Table 6. For sandy soils these amounts may be reduced by one-third, and for clays they should be increased by one-half.

### Magnesium Recommendations

The most practical way to supply Mg is through the use of dolomitic limestone. Where Mg is low and lime is recommended, a comment will be printed on the report stating that "both soil acidity and low Mg can be corrected by applying dolomitic lime." Some crops have a higher requirement than

Table 5. Acidifying Effect of Some Common Fertilizers and Soil Amendmends

Material	Pure CaCO <sub>3</sub> needed to neutralize acidity in 100 pounds of material
	<u>Lb.</u>
Ammonium nitrate .....	60
Ammonium sulfate .....	110
32% liquid nitrogen .....	55
Urea .....	81
Sulfur-coated urea .....	118
Diammonium phosphate .....	70
Flowers of sulfur (elemental S) .....	312
Aluminum sulfate .....	45
Iron sulfate .....	35

Table 6. Pounds of Elemental Sulfur<sup>1</sup> Per 100 Square Feet Needed to Lower Soil pH of a Silt Loam Soil

Present pH	Desired pH				
	6.5	6.0	5.5	5.0	4.5
	<u>Lb.</u>	<u>Lb.</u>	<u>Lb.</u>	<u>Lb.</u>	<u>Lb.</u>
8.0 .....	3.0	4.0	5.5	7.0	8.0
7.5 .....	2.0	3.5	4.5	6.0	7.0
7.0 .....	1.0	2.0	3.5	5.0	6.0
6.5 .....	---	1.0	2.5	4.0	4.5
6.0 .....	---	---	1.0	2.5	3.5

<sup>1</sup>If aluminum sulfate is used, multiply by 6.

others for Mg and it may be supplied by other sources if lime is not recommended. For some crops, a low rate of dolomitic lime can be recommended at higher pH values to supply the Mg. For certain crops, such as potatoes, blueberries, and pines, a soil pH below 5.5 is desirable and if Mg is low, a fertilizer containing Mg is recommended. The Mg recommendation codes are given in Table 7.

Table 7. Magnesium Recommendation Codes

---

**Code 1.** If magnesium is low and lime is recommended, print comment 221: Both soil acidity and low magnesium can be corrected by applying dolomitic lime at the recommended rate.

If magnesium is low and lime is not recommended, do not mention magnesium. (These crops have not been shown to respond to magnesium.)

**Code 2.** If magnesium is low and lime is recommended, print comment 221: Both soil acidity and low magnesium can be corrected by applying dolomitic lime at the recommended rate.

If magnesium is low and lime is not recommended, print comment 222: Low magnesium may be corrected by applying 25 pounds per acre of Mg as magnesium sulfate, magnesium oxide, or sulfate of potash-magnesium; or if the pH is 6.5 or below by applying 1,000 pounds per acre of dolomitic limestone (cotton, vegetable crops, and orchards)

**Code 3.** If magnesium is low and lime is recommended, print comment 221: Both soil acidity and low magnesium can be corrected by applying dolomitic lime at the recommended rate.

If lime is not recommended and Mg is low, print comment 223: Low magnesium may be corrected by applying 25 pounds per acre of Mg as magnesium sulfate, magnesium oxide, or sulfate of potash-magnesium. Potatoes, blueberries, pines, and tobacco have a high Mg requirement but are sensitive to high pH.

---

### Soil Organic Matter

Soil organic matter affects the CEC, nitrogen supplying capacity, and other fertility factors. The organic matter content of most Alabama soils is low (less than 3%) and does not vary widely among soils. Therefore, organic matter analysis is not needed in making fertilizer and lime recommendations, and routine soil samples are not analyzed for organic matter.

Organic matter content and cation exchange capacity are considered in determining the rates of some herbicides required for satisfactory weed control. The CEC is indicated by the soil group in which samples are classified. This should give some indication of the amount of herbicide that should be used. The Soil Testing Laboratory will determine organic matter content of soil samples on special request. A special charge is made for this service. Those desiring organic matter analysis should request it on the information sheets submitted with soil samples.

## Fertilizer Recommendation

Fertilizers are recommended in pounds per acre of N, P<sub>2</sub>O<sub>5</sub>, and K<sub>2</sub>O. Other recommendations are printed as comments on the report. The recommendations are based on regression equations for crops and soil groups. Recommended fertilizer rates will be in 10 pound increments with a minimum recommendation of 40 pounds per acre of any nutrient.

Specific fertilizer grades (13-13-13, 8-24-24, 15-0-15, etc.) are not recommended because of the availability of so many grades that could be used. Most fertilizer dealers will custom blend specific grades to meet the needs of the customer when more than one ton of fertilizer is ordered.

For home gardens and specialty crops, the choice of grades is more limited. In these cases, specific grades are mentioned in comments. The use of a grade such as 13-13-13 as an example, does not indicate that purchasers should insist on this specific grade, but that any equivalent ratio may be substituted. If 10-10-10 is used instead of 13-13-13, the amount used should be increased about 30% and the result will be the same. If concentrated superphosphate, which contains 46% P<sub>2</sub>O<sub>5</sub>, is used instead of superphosphate, which contains 20% P<sub>2</sub>O<sub>5</sub>, the amount used should be reduced by about 55%. The same is true for nitrogen sources and other materials.

Table 8. Most Frequently Recommended Grades and Ratios

N-P <sub>2</sub> O <sub>5</sub> -K <sub>2</sub> O ratios	Common grades	N-P <sub>2</sub> O <sub>5</sub> -K <sub>2</sub> O ratios	Common grades	Fertilizer material	Common grades
0-1-1	0-20-20	X-1-2	5-15-30	Ammonium	
0-1-2	0-10-20	1-4-2	4-16-8	nitrate	33-0-0
0-2-1	0-16-8	1-3-3	4-12-12	Concentrated	
1-0-1	15-0-15	1-3-3	8-24-24	superphosphate	0-46-0
1-1-1	8-8-8	1-3-0	18-46-0	Muriate of	
1-1-1	13-13-13			potash	0-0-60

## Yield Potential (Yield Goal)

Over fertilizing based upon arbitrary "yield goals" results in economic losses to the grower and severe water quality problems in some parts of the United States. Auburn University's soil test calibrations and recommendations are based on maximum economical yields from actual experiments conducted on experiment stations and farms throughout Alabama under both irrigated (where possible) and nonirrigated conditions. Phosphorous and potassium rates are rarely related to yield potential but may be adjusted based upon anticipated crop removal (e.g. forage crops). Nitrogen rates for grain crops (e.g. corn) and cotton may need to be adjusted up or down based upon yield potential. Conditions for adjustments are usually given in comments. However, sources of fertilizer and timing of application may have as much impact on crop yields as the total annual rate used.

### Soil Testing Ratings

Soil test results are rated based on soil type and crop to be grown. Very Low (VL) means that the crop may yield only 50 to 75% of its potential. Medium (M) soil will yield 75 to 100% of its potential. High (H) is the desirable level which should be the objective of most soil building programs. It means that the supply of the nutrient in the soil is adequate for the crop. Very High (VH) means that the soil supply of the nutrient is more than double the amount considered adequate. Extremely High (EH) is used on soils where the P or K level is excessive and further additions of P may be detrimental. These ratings are based on the amount of nutrient that is extracted from the soil.

For example, using a soil that is in a soil group 2, the soil ratings would be as follows based on extractable nutrients.

Soil test rating	K				
	P All crops	Cotton, most legumes	Soybeans, peanuts, grasses	Mg All crops	Ca Peanuts
	Extractable nutrients, lb/acre				
Very low	0-12	0-45	0-30	—	—
Low	13-25	46-90	31-60	0-25	0-300
Medium	26-50	91-180	61-120	—	—
High	51-100	181-360	121-240	26+	300+
Very high	101-200	361-720	241-480	—	—
Extremely high	201+	721+	481+	—	—

Fertilizer Recommendations

Fertilizer recommendations are for annual applications unless otherwise indicated. Follow these for 2 or not more than 3 years and then resample. Rates of P and K recommended for soils testing Medium may be applied broadcast or in the row. On soils testing Low or Very Low, some fertilizer should be placed in the row.

Rates of fertilizer recommended are based on yield response obtained in experiments conducted on soils similar to the one sampled. Phosphorus and potassium recommendations are in one of the approved  $P_2O_5$  to  $K_2O$  ratios. Select a fertilizer grade with the ratio recommended. Plant nutrients are listed on a fertilizer tag or label in the order of  $N-P_2O_5-K_2O$ . For example, 100 pounds of 4-8-16 contains 4 pounds of N, 8 pounds of  $P_2O_5$ , and 16 pounds of  $K_2O$ . Calculate the amount required to supply rates of  $P_2O_5$  and  $K_2O$  recommended. Additional nitrogen recommended may be applied as a side or top dressing.

### Lime Recommendations

Lime should not be applied without a reliable soil test. The rate recommended is in tons of agricultural limestone with 90% calcium carbonate equivalent and ground so that at least 90% passes a 10-mesh and 50% passes a 60-mesh sieve. The amount of lime recommended is based on a plow depth of 8 inches. If soil is plowed to a greater depth the rate of lime should be increased at least 1/8 for each additional inch of depth. Lime should be thoroughly mixed with the soil of the plow layer rather than turned to the bottom of the furrow.

### INTERPRETING REPORT OF SOIL TESTS

#### Secondary and Micronutrient Elements

All soil samples are analyzed for calcium (Ca) and magnesium (Mg). Calcium is not reported except for peanuts and tomatoes, but is used in calculating the cation exchange capacity, which determines the soil group. Dolomitic lime is recommended on acid soils testing low in Mg. Sulfur is not determined because the amount in the topsoil is not a reliable indication of the need for this element. All mixed fertilizers should contain enough S to supply 10 lbs. per acre per year. This is especially important on the sandy soils of Group 1.

Soil tests for micronutrients (B, Zn, and Mo) have not been adequately calibrated to serve as a basis for recommendations on most Alabama soils. On crops and soil conditions where a response is likely, recommendations for B, Zn, and Mo are printed as comments.

#### Most Frequently Recommended Grades and Ratios

N- $P_2O_5$ - $K_2O$ Common	Common	N- $P_2O_5$ - $K_2O$ material	Common	Fertilizer
2	5-15-30	Ammonium		
0-1-2	0-10-20	1-4-2	4-16-8 nitrate	33-0-0
0-2-1	0-16-8	1-3-3	4-12-12 Concentrated	
1-0-1	15-0-15	1-3-3	8-24-24 superphosphate	0-46-0
1-1-1	8-8-8	1-3-0	18-46-0 Muriate of potash	0-0-60
1-1-1	13-13-13			

#### Examples of Sources of Secondary and Micronutrient Elements

Element and Materials	% of Element	Pounds for 1lb.Nutrient	Element and Materials	% of Element	Pounds for 1lb.Nutrient
<b>Magnesium (Mg)</b>			<b>Zinc (Zn)</b>		
Dolomitic Limestone	12	8	Zinc Sulfate	38	3
Magnesium Sulfate	16	6	Zinc Oxide	68	2
Sulfate Potash-Magnesium	10	10	Zinc Chelate	14	7
Boron (B)			<b>Sulfur (S)</b>		
Borax Fertilizer	11	9	Gypsum	19	5
Borate 46 Fertilizer	14	7	Ammonium Sulfate	24	4
Borate 65	20	5	Elemental Sulfur	100	1
Solubor	20	5	Potassium Sulfate	18	5
<b>Iron (Fe)</b>			Superphosphate (20%)	12	8
Iron Sulfate	35	3	Ammonium Thiosulfate	26	4
Iron Chelate	14	7			
Iron Chelate	10	10			
Iron Chelate	6	17			

For additional information contact the County Extension Office.

REPORT ON SOIL TESTS  
 AUBURN UNIVERSITY  
 SOIL TESTING LABORATORY  
 AUBURN UNIVERSITY, AL 36849-5411

PAGE \_\_\_\_\_ OF \_\_\_\_\_

COPY \_\_\_\_\_ OF \_\_\_\_\_

NAME ALABAMA RESIDENT  
 ADDRESS 118 MAIN STREET  
 CITY HOMETOWN, AL 36830

COUNTY LEE  
 DISTRICT 2  
 DATE 10/20/92

LAB No.	SENDER'S SAMPLE DESIGNATION	CROP TO BE GROWN	SOIL* GROUP	pH**	SOIL TEST RESULTS				RECOMMENDATIONS			
					Phosphorus P***	Potassium K***	Magnesium Mg***	Calcium Ca***	LIME-STONE	N	P <sub>2</sub> O <sub>5</sub>	K <sub>2</sub> O
					Pounds per acre				Tons/acre	Pounds per acre		
40639	1 SEE COMMENT 224	SOYBEANS	2	5.3	L 20	M 90	H 100	***	2.0	0	60	50
40640	2 SEE COMMENT 224 SEE COMMENT 15	CORN	1	5.6	L 20	M 60	H 50	***	1.0	120	50	160
40641	3	BAHIA	1	6.0	M 40	H 100	H 100	***	0.0	60	40	0
40642	GARDEN SEE COMMENT 224 SEE COMMENT 82	VEGETABLES	3	5.2	M 25	M 180	H 150	***	3.0	120	100	100

COMMENT NO: 224 SOIL ACIDITY (LOW pH) CAN BE CORRECTED WITH EITHER DOLOMITIC OR CALCITIC LIME

COMMENT NO: 15 CORN ON SANDY SOILS MAY RESPOND TO NITROGEN RATES UP TO 150 LBS. PER ACRE. ON SANDY SOILS APPLY 3 LBS. ZINC (Zn) PER ACRE IN FERTILIZER AFTER LIMING OR WHERE pH IS ABOVE 6.0.

COMMENT NO: 82 PER 100 FT OF ROW APPLY 6 LBS. 8-8-8 (3 QUARTS) AT PLANTING AND SIDEDRESS WITH 4 LBS. 8-8-8 (2 QUARTS).

\*\*\*ON SUMMER GRASS PASTURES APPLY P AND K AS RECOMMENDED AND 60 LBS. OF N BEFORE GROWTH STARTS. UP TO SEPTEMBER 1 REPEAT THE N APPLICATIONS WHEN MORE GROWTH IS DESIRED.

\*\*\* 1.0 TON LIMESTONE PER ACRE IS APPROXIMATELY EQUIVALENT TO 50 LBS. PER 1,000SQ. FT.

\*\*\* FOR CAULIFLOWER, BROCCOLI AND ROOT CROPS, APPLY 1.0 LB. OF BORON (B) PER ACRE (FOR HOME GARDENS, 1 TABLESPOON BORAX PER 100 FT. OF ROW.

- \*1. Sandy soils (CEC < 4.6 cmol<sub>c</sub>kg<sup>-1</sup>)      3. Clays and soils high in organic matter (CEC > 9.0 cmol<sub>c</sub>kg<sup>-1</sup>)
- 2. Loams & Light clays (CEC 4.6-9.0 cmol<sub>c</sub>kg<sup>-1</sup>)      4. Clays of the Blackbelt (CEC > 9.0 cmol<sub>c</sub>kg<sup>-1</sup>)

\*\* 7.4 or higher - Alkaline      6.8-7.3 - Neutral      6.5 or lower - Acid      5.5 or lower - Strongly Acid

\*\*\* Extractable nutrients in pounds per acre

APPROVED \_\_\_\_\_

32



RECOMMENDATIONS FOR FIELD CROPS, FORAGE CROPS, AND PASTURES

Crop Code No. 01

Perennial Summer Grass Pasture  
(Bahia, Bermuda, and Dallis)

Phosphorus	Potassium				
	Very high	High	Medium	Low	Very low
	Pounds N-P <sub>2</sub> O <sub>5</sub> -K <sub>2</sub> O per acre				
Very high ...	60- 0-0	60- 0-0	60- 0-40	60- 0-60	60- 0-80
High .....	60 -0-0	60- 0-0	60- 0-40	60- 0-60	60- 0-80
Medium .....	60-40-0	60-40-0	60-40-40	60-40-60	60-40-80
Low .....	60-60-0	60-60-0	60-60-40	60-60-60	60-60-80
Very low ...	60-80-0	60-80-0	60-80-40	60-80-60	60-80-80

K requirement level . . . . . 1      N rate . . . . . 60  
Lime code no. . . . . 5      PK code no. . . . . 4  
Mg code no. . . . . 1

Fertilizer Recommendation Formula

P <sub>2</sub> O <sub>5</sub>		K <sub>2</sub> O	
Soil group	Eq.	Soil group	Eq.
1 & 2	5	1	7
3	4	2	9
4	6	3	11
		4	12

Comment:

1. On summer grass pastures apply P and K as recommended and 60 pounds of N before growth starts. Repeat the N application up to September 1 when more growth is desired. If less than 40 pounds of N is applied annually, then no P or K is needed.

Crop Code No. 02

Bermuda Hay (Improved Varieties)  
(Bermuda Pasture 01 also Given by Computer)

Phosphorus	Potassium				
	Very high	High	Medium	Low	Very low
	Pounds N-P <sub>2</sub> O <sub>5</sub> -K <sub>2</sub> O per acre				
Very high ..	100- 0-0	100- 0-100	100- 0-200	100- 0-300	100- 0-300
High .....	100- 0-0	100- 0-100	100- 0-200	100- 0-300	100- 0-300
Medium .....	100- 50-0	100- 50-100	100- 50-200	100- 50-300	100- 50-300
Low .....	100- 75-0	100- 75-100	100- 75-200	100- 75-300	100- 75-300
Very low ...	100-100-0	100-100-100	100-100-200	100-100-300	100-100-300

K requirement level . . . . . 1      N rate . . . . . 100  
Lime code no. . . . . 5      PK code no. . . . . 6  
Mg code no. . . . . 1

Fertilizer Recommendation Formula

P <sub>2</sub> O <sub>5</sub>		K <sub>2</sub> O	
Soil group	Eq.	Soil group	Eq.
1 & 2	22	1	131
3	21	2	132
4	23	3	133
		4	134

COMMENT:

22. For bermuda hay, apply N, P, and K as recommended before growth begins and an additional 100 pounds N after each cutting up to September 1. Loss of stand is sometimes due to K deficiency. Where large yields of hay are removed, apply 50 pounds K<sub>2</sub>O per ton of hay removed the previous season.

Crop Code No. 03

Perennial Winter Grass Pasture  
(Fescue, Orchardgrass)

	Potassium				
	Very high	High	Medium	Low	Very low
	Pounds N-P <sub>2</sub> O <sub>5</sub> -K <sub>2</sub> O per acre				
Very high ..	60- 0-0	60- 0-0	60- 0-50	60- 0-80	60- 0-100
High .....	60- 0-0	60- 0-0	60- 0-50	60- 0-80	60- 0-100
Medium .....	60- 50-0	60- 50-0	60- 50-50	60- 50-80	60- 50-100
Low .....	60- 80-0	60- 80-0	60- 80-50	60- 80-80	60- 80-100
Very low ...	60-100-0	60-100-0	60-100-50	60-100-80	60-100-100
K requirement level . . . . .	1		N rate . . . . . 60		
Lime code no. . . . .	1		PK code no. . . . . 3		
Mg code no. . . . .	1				

Fertilizer Recommendation Formula

P <sub>2</sub> O <sub>5</sub>		K <sub>2</sub> O	
Soil group	Eq.	Soil group	Eq.
1 & 2	22	1	24
3	21	2	25
4	23	3	26
		4	28

Comment:

5. Apply N, P, and K as recommended by September 1. Repeat N application in February.

Crop Code No. 04

Temporary Summer Grass Pasture and Johnsongrass (Millet, Forage Sorghum, Sudangrass, Sorghum-Sudagrass Hybrids)

	Potassium				
	Very high	High	Medium	Low	Very low
	Pounds N-P <sub>2</sub> O <sub>5</sub> -K <sub>2</sub> O per acre				
Very high ..	60- 0-0	60- 0-0	60- 0-60	60- 0-100	60- 0-120
High .....	60- 0-0	60- 0-0	60- 0-60	60- 0-100	60- 0-120
Medium .....	60- 60-0	60- 60-0	60- 60-60	60- 60-100	60- 60-120
Low .....	60-100-0	60-100-0	60-100-60	60-100-100	60-100-120
Very low ...	60-120-0	60-120-0	60-120-60	60-120-100	60-120-120
K requirement level . . . . .	1		N rate . . . . . 60		
Lime code no. . . . .	1		PK code no. . . . . 2		
Mg code no. . . . .	1				

Fertilizer Recommendation Formula

P <sub>2</sub> O <sub>5</sub>		K <sub>2</sub> O	
Soil group	Eq.	Soil group	Eq.
1 & 2	43	1	46
3	42	2	48
4	45	3	51
		4	62

Comment:

6. For temporary summer grass or Johnsongrass, apply N, P, and K as recommended before growth begins. Up to September 1, for Johnsongrass hay, apply at least 50 pounds of K<sub>2</sub>O per ton of hay removed the previous season.

Crop Code No. 05

Annual Legume with Small Grain and Ryegrass  
Arrowleaf Clover, Crimson Clover, Vetch, Caley Peas  
with Oats, Wheat, Rye Ryegrass)

Phosphorus	Potassium				
	Very high	High	Medium	Low	Very low
	Pounds N-P <sub>2</sub> O <sub>5</sub> -K <sub>2</sub> O per acre				
Very high ..	60- 0-0	60- 0-0	60- 0-60	60- 0-100	60- 0-120
High .....	60- 0-0	60- 0-0	60- 0-60	60- 0-100	60- 0-120
Medium .....	60- 60-0	60- 60-0	60- 60-60	60- 60-100	60- 60-120
Low .....	60-100-0	60-100-0	60-100-60	60-100-100	60-100-120
Very low ...	60-120-0	60-120-0	60-120-60	60-120-100	60-120-120
K requirement level . . . . .	1		N rate . . . . . 60		
Lime code no. . . . .	1		PK code no. . . . . 2		
Mg code no. . . . .	1				

Fertilizer Recommendation Formula

P <sub>2</sub> O <sub>5</sub>		K <sub>2</sub> O	
Soil group	Eq.	Soil group	Eq.
1 & 2	43	1	46
3	42	2	48
4	45	3	51
		4	62

Comment:

- 4. On grass-legume mixtures, apply 60 pounds of N in early spring unless no additional forage growth is needed or the legume occupies one-half or more of the ground cover.
- 7. For reseeding clover, or clover seed harvest, apply 1 to 1.5 pounds B per acre.

Crop Code No. 06

White Clover, Arrowleaf Clover, Red Clover

Phosphorus	Potassium				
	Very high	High	Medium	Low	Very low
	Pounds N-P <sub>2</sub> O <sub>5</sub> -K <sub>2</sub> O per acre				
Very high ..	0- 0-0	0- 0-0	0- 0-80	0- 0-120	0- 0-180
High .....	0- 0-0	0- 0-0	0- 0-80	0- 0-120	0- 0-180
Medium .....	0- 80-0	0- 80-0	0- 80-80	0- 80-120	0- 80-180
Low .....	0-120-0	0-120-0	0-120-80	0-120-120	0-120-180
Very low ...	0-180-0	0-180-0	0-180-80	0-180-120	0-180-180
K requirement level . . . . .	2		N rate . . . . . 0		
Lime code no. . . . .	2		PK code no. . . . . 1		
Mg code no. . . . .	1				

Fertilizer Recommendation Formula

P <sub>2</sub> O <sub>5</sub>		K <sub>2</sub> O	
Soil group	Eq.	Soil group	Eq.
1 & 2	80	1	82
3	79	2	84
4	81	3	85
		4	96

Comment:

- 7. For reseeding clover, or clover seed harvest, apply 1 to 1.5 pounds B per acre.

Crop Code No. 07

Perennial or Late-Maturing Legumes with Summer Grass Pasture (White Clover, Arrowleaf Clover, Red Clover, With Dallis, Bermuda, Bahia)

Phosphorus	Potassium				
	Very high	High	Medium	Low	Very low
	Pounds N-P <sub>2</sub> O <sub>5</sub> -K <sub>2</sub> O per acre				
Very high ..	0- 0-0	0- 0-0	0- 0-80	0- 0-120	0- 0-180
High .....	0- 0-0	0- 0-0	0- 0-80	0- 0-120	0- 0-180
Medium .....	0- 80-0	0- 80-0	0- 80-80	0- 80-120	0- 80-180
Low .....	0-120-0	0-120-0	0-120-80	0-120-120	0-120-180
Very low ...	0-180-0	0-180-0	0-180-80	0-180-120	0-180-180
K requirement level . . . . .	2		N rate . . . . . 0		
Lime code no. . . . .	2		PK code no. . . . . 1		
Mg code no. . . . .	1				

Fertilizer Recommendation Formula

P <sub>2</sub> O <sub>5</sub>		K <sub>2</sub> O	
Soil group	Eq.	Soil group	Eq.
1 & 2	80	1	82
3	79	2	84
4	81	3	85
		4	96

Comment:

- 7. For reseeding clover, or clover seed harvest, apply 1 to 1.5 pounds B per acre.
- 8. Where legume covers less than one-third of the ground, apply 60 pounds of N each time forage is grazed down or cut for hay.

Crop Code No. 08

Clover and Winter Perennial Grass Pasture (White Clover, Red Clover with Fescue or Orchardgrass)

Phosphorus	Potassium				
	Very high	High	Medium	Low	Very low
	Pounds N-P <sub>2</sub> O <sub>5</sub> -K <sub>2</sub> O per acre				
Very high ..	0- 0-0	0- 0-0	0- 0-80	0- 0-120	0- 0-180
High .....	0- 0-0	0- 0-0	0- 0-80	0- 0-120	0- 0-180
Medium .....	0- 80-0	0- 80-0	0- 80-80	0- 80-120	0- 80-180
Low .....	0-120-0	0-120-0	0-120-80	0-120-120	0-120-180
Very low ..	0-180-0	0-180-0	0-180-80	0-180-120	0-180-180
K requirement level . . . . .	2		N rate . . . . . 0		
Lime code no. . . . .	2		PK code no. . . . . 1		
Mg code no. . . . .	1				

Fertilizer Recommendation Formula

P <sub>2</sub> O <sub>5</sub>		K <sub>2</sub> O	
Soil group	Eq.	Soil group	Eq.
1 & 2	80	1	82
3	79	2	84
4	81	3	85
		4	96

Comment:

- 7. For reseeding clover, or clover seed harvest, apply 1 to 1.5 pounds B per acre.
- 9. On grass legume mixtures, where legume is less than one-third of the ground cover, apply 60 pounds of N in early fall and repeat if needed in early spring.

Crop Code No. 09

Annual Legume and Summer Grass Pasture  
(Ball Clover, Crimson Clover, and Bermuda, Dallis, Bahia)

Phosphorus	Potassium				
	Very high	High	Medium	Low	Very low
	Pounds N-P <sub>2</sub> O <sub>5</sub> -K <sub>2</sub> O per acre				
Very high ...	0- 0-0	0- 0-0	0- 0-50	0- 0-80	0- 0-100
High .....	0- 0-0	0- 0-0	0- 0-50	0- 0-80	0- 0-100
Medium .....	0- 50-0	0- 50-0	0- 50-50	0- 50-80	0- 50-100
Low .....	0- 80-0	0- 80-0	0- 80-50	0- 80-80	0- 80-100
Very low ...	0-100-0	0-100-0	0-100-50	0-100-80	0-100-100
K requirement level . . . . .	2		N rate . . . . . 0		
Lime code no. . . . .	2		PK code no. . . . . 3		
Mg code no. . . . .	1				

Fertilizer Recommendation Formula

P <sub>2</sub> O <sub>5</sub>		K <sub>2</sub> O	
Soil group	Eq.	Soil group	Eq.
1 & 2	22	1	25
3	21	2	27
4	23	3	29
		4	41

Comment:

- 7. For reseeding clover, or clover seed harvest, apply 1 to 1.5 pounds B per acre.
- 8. Where legume covers less than one-third of the ground, apply 60 pounds of N each time forage is grazed down or cut for hay.

Crop Code No. 10

Cotton

Phosphorus	Potassium				
	Very high	High	Medium	Low	Very low
	Pounds N-P <sub>2</sub> O <sub>5</sub> -K <sub>2</sub> O per acre				
Very high ..	90- 0-0	90- 0-0	90- 0-60	90- 0-90	90- 0-120
High .....	90- 0-0	90- 0-0	90- 0-60	90- 0-90	90- 0-120
Medium .....	90- 60-0	90- 60-0	90- 60-60	90- 60-90	90- 60-120
Low .....	90-100-0	90-100-0	90-100-60	90-100-90	90-100-120
Very low ...	90-120-0	90-120-0	90-120-60	90-120-90	90-120-120
K requirement level . . . . .	2		N rate . . . . . 90		
Lime code no. . . . .	1		PK code no. . . . . 2		
Mg code no. . . . .	2				

Fertilizer Recommendation Formula

P <sub>2</sub> O <sub>5</sub>		K <sub>2</sub> O	
Soil group	Eq.	Soil group	Eq.
1 & 2	43	1	49
3	42	2	52
4	45	3	54
		4	64

Comment:

- 10. For cotton, use the N rate as a guide. Where cotton follows a good crop of soybeans or on land where excessive growth has caused problems with late maturity, insects, or boll rot, reduce the N rate 20 to 30 pounds per acre. Where vegetative growth has been inadequate, increase the N rate by this amount. Apply 0.3 pound of B per acre in the fertilizer or in the insecticide spray or dust. For cotton following hay crops, pasture, or soybeans on soils testing Low or Medium in K, increase K<sub>2</sub>O application 30 to 60 pounds per acre above the amount recommended.

Crop Code No. 10 (Continued)

Starter fertilizer containing 25 to 30 pounds N and 15 to 40 pounds of P<sub>2</sub>O<sub>5</sub> per acre may be used under reduced tillage condition by placing material in a 2 X 2 band, in a subsoil slit, or in a surface-applied band at planting.

Nitrogen may be applied in split applications up to early bloom. Additional N, if needed, can be foliar-applied as urea at rates not exceeding 15 pounds urea per acre per application.

Crop Code No. 13

Corn

Phosphorus	Potassium				
	Very high	High	Medium	Low	Very low
	Pounds N-P <sub>2</sub> O <sub>5</sub> -K <sub>2</sub> O per acre				
Very high ..	120- 0-0	120- 0-0	120- 0-40	120- 0-60	120- 0-80
High .....	120- 0-0	120- 0-0	120- 0-40	120- 0-60	120- 0-80
Medium .....	120-40-0	120-40-0	120-40-40	120-40-60	120-40-80
Low .....	120-60-0	120-60-0	120-60-40	120-60-60	120-60-80
Very low ...	120-80-0	120-80-0	120-80-40	120-80-60	120-80-80
K requirement level . . . . .	1		N rate . . . . . 120		
Lime code no. . . . .	1		PK code no. . . . . 4		
Mg code no. . . . .	1				

Fertilizer Recommendation Formula

P <sub>2</sub> O <sub>5</sub>		K <sub>2</sub> O	
Soil group	Eq.	Soil group	Eq.
1 & 2	5	1	7
3	4	2	9
4	6	3	11
		4	12

Comment:

15. Corn on sandy soils may respond to nitrogen rates up to 150 pounds per acre. On sandy soils apply three pounds Zn per acre in fertilizer after liming or where pH is above 6.0. (Comment to be used only on Class 1 and Class 2 soils.)

Crop Code No. 15

Corn (in Rotation Before Soybeans)

Phosphorus	Potassium				
	Very high	High	Medium	Low	Very low
	Pounds N-P <sub>2</sub> O <sub>5</sub> -K <sub>2</sub> O per acre				
Very high ..	120- 0-0	120- 0-0	120- 0-80	120- 0-120	120- 0-160
High .....	120- 0-0	120- 0-0	120- 0-80	120- 0-120	120- 0-160
Medium .....	120- 80-0	120- 80-0	120- 80-80	120- 80-120	120- 80-160
Low .....	120-160-0	120-160-0	120-160-80	120-160-120	120-160-160
Very low ...	120-160-0	120-160-0	120-160-80	120-160-120	120-160-160
K requirement level . . . . .	1		N rate . . . . . 120		
Lime code no. . . . .	1		PK code no. . . . . 11		
Mg code no. . . . .	1				

Fertilizer Recommendation Formula

P <sub>2</sub> O <sub>5</sub>		K <sub>2</sub> O	
Soil group	Eq.	Soil group	Eq.
1 & 2	74	1	75
3	73	2	76
4	75	3	77
		4	78

Comment:

15. Corn on sandy soils may respond to nitrogen rates up to 150 pounds per acre. On sandy soils apply three pounds Zn per acre in fertilizer after liming or where pH is above 6.0. (Comment to be used only on Class 1 and Class 2 soils.)

Crop Code No. 16

Irrigated Corn, Corn, or Sorghum Silage

Phosphorus

Potassium

	Very high	High	Medium	Low	Very low
	Pounds N-P <sub>2</sub> O <sub>5</sub> -K <sub>2</sub> O per acre				
Very high ..	180- 0-0	180- 0-30	180- 0-60	180- 0-120	180- 0-120
High .....	180- 30-0	180- 30-30	180- 30-60	180- 30-120	180- 30-120
Medium .....	180- 60-0	180- 60-30	180- 60-60	180- 60-120	180- 60-120
Low .....	180-120-0	180-120-30	180-120-60	180-120-120	180-120-120
Very low ...	180-120-0	180-120-30	180-120-60	180-120-120	180-120-120

K requirement level . . . . . 1      N rate . . . . . 180  
 Lime code no. . . . . 1      PK code no . . . . . 26  
 Mg code no. . . . . 1

Fertilizer Recommendation Formula

P <sub>2</sub> O <sub>5</sub>		K <sub>2</sub> O	
Soil group	Eq.	Soil group	Eq.
1 & 2	35	1	58
3	32	2	60
4	37	3	62
		4	63

Comment:

16. On sandy soils apply three pounds Zn per acre in fertilizer after liming or where pH is above 6.0. (Comment to be used only on Class 1 and 2 soils.)

Peanuts

Phosphorus	Potassium				
	Very high	High	Medium	Low	Very low
	Pounds N-P <sub>2</sub> O <sub>5</sub> -K <sub>2</sub> O per acre				
Very high ..	0- 0-0	0- 0-0	0- 0-40	0- 0-80	0- 0-120
High .....	0- 0-0	0- 0-0	0- 0-40	0- 0-80	0- 0-120
Medium .....	0- 40-0	0- 40-0	0- 40-40	0- 40-80	0- 40-120
Low .....	0- 80-0	0- 80-0	0- 80-40	0- 80-80	0- 80-120
Very low ...	0-120-0	0-120-0	0-120-40	0-120-80	0-120-120
K requirement level . . . . .	1			N rate . . . . . 0	
PK code no. . . . .	1			PK code no . . . . . 5	
Mg code no. . . . .	1				

Fertilizer Recommendation Formula

P <sub>2</sub> O <sub>5</sub>		K <sub>2</sub> O	
Soil group	Eq.	Soil group	Eq.
1 & 2	31	1	34
3	30	2	36
4	33	3	38
		4	53

Comment:

- 11. For peanuts apply 0.3 to 0.5 pound B per acre in the fertilizer, gypsum, or disease control spray or dust.
- 13. Apply 250 pounds of gypsum at blooming time. (Where calcium is medium and no lime is recommended or calcium is low and lime is recommended.)
- 14. Apply 500 pounds of gypsum at blooming time. (Where calcium is low and no lime is recommended.)

Annual Legumes (Crimson Clover, Ball Clover, Annual Lespedeza, Caley Peas, and Vetch)

Phosphorus	Potassium				
	Very high	High	Medium	Low	Very low
	Pounds N-P <sub>2</sub> O <sub>5</sub> -K <sub>2</sub> O per acre				
Very high ...	0- 0-0	0- 0-0	0- 0-50	0- 0-80	0- 0-100
High .....	0- 0-0	0- 0-0	0- 0-50	0- 0-80	0- 0-100
Medium .....	0- 50-0	0- 50-0	0- 50-50	0- 50-80	0- 50-100
Low .....	0- 80-0	0- 80-0	0- 80-50	0- 80-80	0- 80-100
Very low ....	0-100-0	0-100-0	0-100-50	0-100-80	0-100-100
K requirement level . . . . .	2			N rate . . . . . 0	
Lime code no. . . . .	1			PK code no . . . . . 3	
Mg code no. . . . .	1				

Fertilizer Recommendation Formula

P <sub>2</sub> O <sub>5</sub>		K <sub>2</sub> O	
Soil group	Eq.	Soil group	Eq.
1 & 2	22	1	25
3	21	2	27
4	23	3	29
		4	41

Comment:

- 7. For reseeding clover, or clover seed harvest, apply 1 to 1.5 pounds B per acre.



Crop Code No. 20

Southern Peas

Phosphorus	Potassium				
	Very high	High	Medium	Low	Very low
	Pounds N-P <sub>2</sub> O <sub>5</sub> -K <sub>2</sub> O per acre				
Very high ...	30- 0-0	30- 0-0	30- 0-50	30- 0-80	30- 0-100
High.....	30- 0-0	30- 0-0	30- 0-50	30- 0-80	30- 0-100
Medium .....	30- 50-0	30- 50-0	30- 50-50	30- 50-80	30- 50-100
Low .....	30- 80-0	30- 80-0	30- 80-50	30- 80-80	30- 80-100
Very low ....	30-100-0	30-100-0	30-100-50	30-100-80	30-100-100
K requirement level . . . . .	2		N rate . . . . . .30		
Lime code no. . . . .	1		PK code no . . . . . 3		
Mg code no. . . . .	1				

Fertilizer Recommendation Formula

P <sub>2</sub> O <sub>5</sub>		K <sub>2</sub> O	
Soil group	Eq.	Soil group	Eq.
1 & 2	22	1	25
3	21	2	27
4	23	3	29
		4	41

Crop Code No. 21

Grain Sorghum, Sweet Sorghum, Sugar Cane, and Sunflower

Phosphorus	Potassium				
	Very high	High	Medium	Low	Very low
	Pounds N-P <sub>2</sub> O <sub>5</sub> -K <sub>2</sub> O per acre				
Very high ...	80- 0-0	80- 0-0	80- 0-40	80- 0-60	80- 0-80
High .....	80- 0-0	80- 0-0	80- 0-40	80- 0-60	80- 0-80
Medium .....	80-40-0	80-40-0	80-40-40	80-40-60	80-40-80
Low .....	80-60-0	80-60-0	80-60-60	80-60-60	80-60-80
Very low ....	80-80-0	80-80-0	80-80-40	80-80-60	80-80-80
K requirement level . . . . .	1		N rate . . . . . .80		
Lime code no. . . . .	1		PK code no . . . . . 4		
Mg code no. . . . .	1				

Fertilizer Recommendation Formula

P <sub>2</sub> O <sub>5</sub>		K <sub>2</sub> O	
Soil group	Eq.	Soil group	Eq.
1 & 2	5	1	7
3	4	2	9
4	6	3	11
		4	12

Crop Code No. 22

Alfalfa

	Potassium				
	Very high	High	Medium	Low	Very low
	Pounds N-P <sub>2</sub> O <sub>5</sub> -K <sub>2</sub> O per acre				
Very high ...	0- 0-0	0- 0-120	0- 0-240	0- 0-360	0- 0-480
High .....	0- 0-0	0- 0-120	0- 0-240	0- 0-360	0- 0-480
Medium .....	0- 80-0	0- 80-120	0- 80-240	0- 80-360	0- 80-480
Low .....	0-120-0	0-120-120	0-120-240	0-120-360	0-120-480
Very low ....	0-200-0	0-200-120	0-200-240	0-200-360	0-200-480
K requirement level . . . . .	2		N rate . . . . . 0		
Lime code no. . . . .	3		PK code no . . . . . 7		
Mg code no. . . . .	1				

Fertilizer Recommendation Formula

P <sub>2</sub> O <sub>5</sub>		K <sub>2</sub> O	
Soil group	Eq.	Soil group	Eq.
1 & 2	89	1	135
3	87	2	136
4	92	3	137
		4	138

Comment:

- 21. For establishment of alfalfa apply at least 50 pounds K<sub>2</sub>O per ton of anticipated hay removed.
- 23. For alfalfa apply three pounds of B per acre annually.

Crop Code No. 23

Sericea Lespedeza

	Potassium				
	Very high	High	Medium	Low	Very low
	Pounds N-P <sub>2</sub> O <sub>5</sub> -K <sub>2</sub> O per acre				
Very high ...	0- 0-0	0- 0-0	0- 0-40	0- 0-80	0- 0-120
High .....	0- 0-0	0- 0-0	0- 0-40	0- 0-80	0- 0-120
Medium .....	0- 40-0	0- 40-0	0- 40-40	0- 40-80	0- 40-120
Low .....	0- 80-0	0- 80-0	0- 80-40	0- 80-80	0- 80-120
Very low ....	0-120-0	0-120-0	0-120-40	0-120-80	0-120-120
K requirement level . . . . .	2		N rate . . . . . 0		
Lime code no. . . . .	1		PK code no . . . . . 5		
Mg code no. . . . .	1				

Fertilizer Recommendation Formula

P <sub>2</sub> O <sub>5</sub>		K <sub>2</sub> O	
Soil group	Eq.	Soil group	Eq.
1 & 2	31	1	36
3	30	2	39
4	33	3	40
		4	54

Comment:

- 24. Fertilizer recommended should be sufficient for two years.

Soybeans

Phosphorus	Potassium				
	Very high	High	Medium	Low	Very low
	Pounds N-P <sub>2</sub> O <sub>5</sub> -K <sub>2</sub> O per acre				
Very high ....	0- 0-0	0- 0-0	0- 0-40	0- 0-80	0- 0-120
High .....	0- 0-0	0- 0-0	0- 0-40	0- 0-80	0- 0-120
Medium .....	0- 40-0	0- 40-0	0- 40-40	0- 40-80	0- 40-120
Low .....	0- 80-0	0- 80-0	0- 80-40	0- 80-80	0- 80-120
Very low ....	0-120-0	0-120-0	0-120-40	0-120-80	0-120-120
K requirement level . . . . .	2		N rate . . . . . 0		
Lime code no. . . . .	1		PK code no . . . . . 5		
Mg code no. . . . .	1				

Fertilizer Recommendation Formula

P <sub>2</sub> O <sub>5</sub>		K <sub>2</sub> O	
Soil group	Eq.	Soil group	Eq.
1 & 2	31	1	36
3	30	2	39
4	33	3	40
		4	54

Small Grain - Soybean Rotation

Phosphorus	Potassium				
	Very high	High	Medium	Low	Very low
	Pounds N-P <sub>2</sub> O <sub>5</sub> -K <sub>2</sub> O per acre				
Very high ..	100- 0-0	100- 0-0	100- 0-80	100- 0-120	100- 0-160
High .....	100- 0-0	100- 0-0	100- 0-80	100- 0-120	100- 0-160
Medium .....	100- 80-0	100- 80-0	100- 80-80	100- 80-120	100- 80-160
Low .....	100-160-0	100-160-0	100-160-80	100-160-120	100-160-160
Very low ...	100-160-0	100-160-0	100-160-80	100-160-120	100-160-160
K requirement level . . . . .	1		N rate . . . . . 100		
Lime code no. . . . .	1		PK code no . . . . . 11		
Mg code no. . . . .	1				

Fertilizer Recommendation Formula

P <sub>2</sub> O <sub>5</sub>		K <sub>2</sub> O	
Soil group	Eq.	Soil group	Eq.
1 & 2	90	1	75
3	88	2	76
4	93	3	77
		4	78

Comment:

25. If the recommended amounts of P and K are applied to small grain in the fall, no additional P or K should be needed for soybeans the following year.

34. For small grains and ryegrass planted on fallowed fields in early September for grazing, apply 100 pounds of N at planting and 60 pounds in early spring for grazing or grain. Those crops grown for grain only should receive 20 pounds of N in the fall and 60 pounds in the spring. Ryegrass planted alone for grazing should receive no more than 60 pounds of N in the fall and up to 100 pounds N in the early spring.

Tobacco (Flue Cured)

Phosphorus	Potassium				
	Very high	High	Medium	Low	Very low
	Pounds N-P <sub>2</sub> O <sub>5</sub> -K <sub>2</sub> O per acre				
Very high ..	60- 50-100	60- 60-120	60- 80-160	60- 50-200	60- 50-200
High .....	60- 50-100	60- 60-120	60- 80-160	60- 50-200	60- 50-200
Medium .....	60-100-100	60-120-120	60-100-200	60-100-200	60-100-200
Low .....	60-200-100	60-200-100	60-200-200	60-200-200	60-200-200
Very low ...	60-200-100	60-200-100	60-200-200	60-200-200	60-200-200
K requirement level . . . . .	2		N rate . . . . . .60		
Lime code no. . . . .	4		PK code no . . . . . 8		
Mg code no. . . . .	3				

Fertilizer Recommendation Formula

P <sub>2</sub> O <sub>5</sub>		K <sub>2</sub> O	
Soil group	Eq.	Soil group	Eq.
1 & 2	112	1	116
3	111	2	118
4	113	3	119
		4	119

Note:

Increase N to 140 pounds per acre for Burley and Darkfire tobacco.

Small Grain or Temporary Winter Grass Pasture  
(Oats, Rye, Wheat, Ryegrass)

Phosphorus	Potassium				
	Very high	High	Medium	Low	Very low
	Pounds N-P <sub>2</sub> O <sub>5</sub> -K <sub>2</sub> O per acre				
Very high ..	100- 0-0	100- 0-0	100- 0-60	110- 0-100	100- 0-120
High .....	100- 0-0	100- 0-0	100- 0-60	100- 0-100	100- 0-120
Medium .....	100- 60-0	100- 60-0	100- 60-60	100- 60-100	100- 60-120
Low .....	100-100-0	100-100-0	100-100-60	100-100-100	100-100-120
Very low ...	100-120-0	100-120-0	100-120-60	100-120-100	100-120-120
K requirement level . . . . .	1		N rate . . . . . . 100		
Lime code no. . . . .	1		PK code no . . . . . 2		
Mg code no. . . . .	1				

Fertilizer Recommendation Formula

P <sub>2</sub> O <sub>5</sub>		K <sub>2</sub> O	
Soil group	Eq.	Soil group	Eq.
1 & 2	43	1	46
3	42	2	48
4	45	3	51
		4	62

Comment:

34. For small grains and ryegrass planted on fallowed fields in early September for grazing, apply 100 pounds of N at planting and 60 pounds in early spring. Ryegrass planted alone for grazing should receive no more than 60 pounds of N in the fall and up to 100 pounds in the early spring.

For grain only, apply 20 pounds N per acre in the fall and 60 to 80 pounds in the spring. The fall N can be eliminated following a good soybean crop or other legume.

RECOMMENDATIONS FOR TURFGRASS, LAWNS, GOLF COURSES, ATHLETIC FIELDS, AND ROADSIDES

Crop Code No. 40

Bermuda, Zoysia, St. Augustine Lawn

Phosphorus	Potassium				
	Very high	High	Medium	Low	Very low
	Pounds N-P <sub>2</sub> O <sub>5</sub> -K <sub>2</sub> O per acre				
Very high ...	80- 0-0 (27)	80- 0-0 (27)	80- 0-40 (28)	80- 0-80 (29)	80- 0-80 (29)
High .....	80- 0-0 (27)	80- 0-0 (27)	80- 0-40 (31)	80- 0-80 (32)	80- 0-80 (32)
Medium .....	80-40-0 (30)	80-40-0 (30)	80-40-40 (31)	80-40-80 (32)	80-40-80 (32)
Low .....	80-80-0 (33)	80-80-0 (33)	80-80-40 (35)	80-80-80 (35)	80-80-80 (35)
Very low ...	80-80-0 (33)	80-80-0 (33)	80-80-40 (35)	80-80-80 (35)	80-80-80 (35)
K requirement level . . . . .	2		N rate . . . . . .80		
Lime code no. . . . .	5		PK code no . . . . . .12		
Mg code no. . . . .	1				

Fertilizer Recommendation Formula

P <sub>2</sub> O <sub>5</sub>		K <sub>2</sub> O	
Soil group	Eq.	Soil group	Eq.
1 & 2	14	1	16
3	13	2	17
4	15	3	18
		4	19

Comment:

26. One ton limestone per acre is approximately equivalent to 50 pounds per 1,000 square feet. Suggestions for meeting recommendations:

27. Per 1,000 square feet apply one pound N (three pounds ammonium nitrate or equivalent) when spring growth begins and repeat in mid-summer. If more growth or better color is desired make additional applications of one pound N at two-month intervals.

28. Per 1,000 square feet apply six pounds 15-0-15, or equivalent low phosphorus fertilizer, when spring growth begins and apply one pound N (three pounds ammonium nitrate or equivalent) in mid-summer. If more growth or better color is desired, make additional applications of one pound N at two-month intervals.

29. Per 1,000 square feet apply six pounds 15-0-15, or equivalent low phosphorus fertilizer, when spring growth begins and repeat in mid-summer. If more growth or better color is desired, make additional applications of one pound N (three pounds ammonium nitrate or equivalent) at two-month intervals.

30. Per 1,000 square feet apply one pound N (three pounds ammonium nitrate or equivalent) and five pounds superphosphate or equivalent when spring growth begins and apply one pound N in mid-summer. If more growth or better color is desired, make additional applications of one pound N at two-month intervals.

31. Per 1,000 square feet apply 12 pounds 13-13-13 or equivalent when spring growth begins and apply one pound N (three pounds ammonium nitrate or equivalent) in mid-summer. If more growth or better color is desired, make additional applications of one pound N at two-month intervals.

32. Per 1,000 square feet apply 12 pounds 13-13-13 or equivalent when spring growth begins and apply six pounds 15-0-15 or equivalent low phosphorus fertilizer in mid-summer. If more growth or better color is desired, make additional applications of one pound N (three pounds ammonium nitrate or equivalent) at two-month intervals.

33. Per 1,000 square feet apply 10 pounds superphosphate or equivalent and one pound N (three pounds ammonium nitrate or equivalent) when spring growth begins and apply one pound N in mid-summer. If more growth or better color is desired, make additional applications of one pound N at two-month intervals.

35. Per 1,000 square feet apply 12 pounds 13-13-13 or equivalent when spring growth begins and repeat in mid-summer. If more growth or better color is desired, make additional applications of one pound N (three pounds ammonium nitrate or equivalent) at two-month intervals.

112. Final remark. For small areas, comments give examples of ways to meet the fertilizer recommendations. Other fertilizer grades or materials that supply equivalent amounts of plant nutrients may be used with equal results. If you need assistance in calculating amounts of other materials to use, contact your county agent or fertilizer supplier.

Centipede Lawn

Phosphorus	Potassium				
	Very high	High	Medium	Low	Very low
Pounds N-P <sub>2</sub> O <sub>5</sub> -K <sub>2</sub> O per acre					
Very high ...	40- 0-0 (39)	40- 0-0 (39)	40- 0-40 (40)	40- 0-40 (40)	40- 0-40 (40)
High .....	40- 0-0 (39)	40- 0-0 (39)	40- 0-40 (40)	40- 0-40 (40)	40- 0-40 (40)
Medium .....	40-40-0 (39)	40-40-0 (39)	40-40-40 (44)	40-40-40 (44)	40-40-40 (44)
Low .....	40-40-0 (43)	40-40-0 (43)	40-40-40 (44)	40-40-40 (44)	40-40-40 (44)
Very low ....	40-40-0 (43)	40-40-0 (43)	40-40-40 (44)	40-40-40 (44)	40-40-40 (44)
K r-requirement level . . . . .	2		N rate . . . . . .40		
Lime code no. . . . .	0		PK code no . . . . . .13		
Mg code no. . . . .	1				

Comment:

- 26. One ton limestone per acre is approximately equivalent to 50 pounds per 1,000 square feet.
- 38. The low fertilizer requirement does not justify use of recommendation formula.
- 39. Per 1,000 square feet apply one pound N (three pounds ammonium nitrate or equivalent) when spring growth begins. If phosphorus is excessive, fertilizers containing this element should not be used. Excessive phosphorus may cause an iron deficiency. The symptoms occur as a general yellowing of new growth. To correct, spray with a soluble source of iron which can be found at garden supply stores.
- 40. Per 1,000 square feet apply six pounds 15-0-15 or equivalent low phosphorus fertilizer when spring growth begins. If phosphorus is excessive, fertilizers containing this element should not be used. Excessive phosphorus may cause an iron deficiency. The symptoms occur as a general yellowing of new growth. To correct, spray with a soluble source of iron which can be found at garden supply store.
- 43. Per 1,000 square feet apply one pound N (three pounds ammonium nitrate or equivalent) and five pounds superphosphate or equivalent when spring growth begins.
- 44. Per 1,000 square feet apply 12 pounds 13-13-13 or equivalent when spring growth begins.
- 112. Final remark. For small area, comments give examples of ways to meet the fertilizer recommendations. Other fertilizer grades or materials that supply equivalent amounts of plant nutrients may be used with equal results. If you need assistance in calculating amounts of other materials to use, contact your county agent or fertilizer supplier.

Winter Lawn  
(Ryegrass, Fescue, Bluegrass)

Phosphorus	Potassium				
	Very high	High	Medium	Low	Very low
Pounds N-P <sub>2</sub> O <sub>5</sub> -K <sub>2</sub> O per acre					
Very high ...	80- 0-0 (45)	80- 0-0 (45)	80- 0-40 (46)	80- 0-80 (47)	80- 0-80 (47)
High .....	80- 0-0 (45)	80- 0-0 (45)	80-40-40 (49)	80-40-80 (50)	80-40-80 (50)
Medium .....	80-40-0 (48)	80-40-0 (48)	80-40-40 (49)	80-40-80 (50)	80-40-80 (50)
Low .....	80-80-0 (51)	80-80-0 (51)	80-80-40 (53)	80-80-80 (53)	80-80-80 (53)
Very low ....	80-80-0 (51)	80-80-0 (51)	80-80-40 (53)	80-80-80 (53)	80-80-80 (53)

K requirement level . . . . . 2      N rate . . . . . .80  
Lime code no. . . . . . 5      PK code no . . . . . .12  
Mg code no. . . . . . 1

Fertilizer Recommendation Formula

P <sub>2</sub> O <sub>5</sub>		K <sub>2</sub> O	
Soil group	Eq.	Soil group	Eq.
1 & 2	14	1	16
3	13	2	17
4	15	3	18
		4	19

Comment:

- 26. One ton limestone per acre is approximately equivalent to 50 pounds per 1,000 square feet.
- 45. Per 1,000 square feet apply one pound N (three pounds ammonium nitrate or equivalent) in the fall and repeat in the spring. If more growth or better color is desired, add one pound N at two-month intervals.
- 46. Per 1,000 square feet apply six pounds 15-0-15 or equivalent low phosphorus fertilizer in the fall and apply one pound N (three pounds ammonium nitrate or equivalent) in the spring. If more growth or better color is desired, add one pound N at two-month intervals.
- 47. Per 1,000 square feet apply six pounds 15-0-15 or equivalent low phosphorus fertilizer in the fall and repeat in the spring. If more growth or better color is desired, add one pound N (three pounds ammonium nitrate or equivalent) at two-month intervals.
- 48. Per 1,000 square feet apply one pound N (three pounds ammonium nitrate or equivalent) and five pounds superphosphate or equivalent in the fall and apply one pound N in the spring. If more growth or better color is desired, add one pound N at two-month intervals.
- 49. Per 1,000 square feet apply 12 pounds 13-13-13 or equivalent in the fall and apply one pound N (three pounds ammonium nitrate or equivalent) in the spring. If more growth or better color is desired, add one pound N at two-month intervals.
- 50. Per 1,000 square feet apply 12 pounds 13-13-13 or equivalent in the fall and apply six pounds 15-0-15 or equivalent low phosphorus fertilizer in the spring. If more growth or better color is desired, add one pound N (three pounds ammonium nitrate or equivalent) at two-month intervals.
- 51. Per 1,000 square feet apply 10 pounds superphosphate or equivalent and one pound N (three pounds ammonium nitrate or equivalent) in the fall and apply one pound N in the spring. If more growth or better color is desired, add one pound N at two-month intervals.
- 53. Per 1,000 square feet apply 12 pounds 13-13-13 or equivalent in the fall and repeat in the spring. If more growth or better color is desired, add one pound N (three pounds ammonium nitrate or equivalent) at two-month intervals.
- 112. Final remark. For small areas, comments give examples of ways to meet the fertilizer recommendations. Other fertilizer grades or materials that supply equivalent amounts of plant nutrients may be used with equal results. If you need assistance in calculating amounts of other materials to use, contact your county agent or fertilizer supplier.

Phosphorus	Potassium				
	Very high	High	Medium	Low	Very low
	Pounds N-P <sub>2</sub> O <sub>5</sub> -K <sub>2</sub> O per acre				
Very high ...	400- 0-0 (54)	400- 0- 0 (54)	400- 0-100 (55)	400- 0-200 (56)	400- 0-200 (56)
High .....	400- 50-0 (54)	400- 50-50 (58)	400- 50-100 (59)	400- 50-200 (60)	400- 50-200 (60)
Medium .....	400-100-0 (61)	400-100-50 (62)	400-100-100 (62)	400-100-200 (63)	400-100-200 (63)
Low .....	400-200-0 (64)	400-200-50 (65)	400-200-100 (65)	400-200-200 (66)	400-200-200 (66)
Very low ....	400-200-0 (64)	400-200-50 (65)	400-200-100 (65)	400-200-200 (66)	400-200-200 (66)

K requirement level . . . . . 2      N rate . . . . . 400  
 Lime code no. . . . . 1      PK code no . . . . . 14  
 Mg code no. . . . . 1

## Fertilizer Recommendation Formula

P <sub>2</sub> O <sub>5</sub>		K <sub>2</sub> O	
Soil group	Eq.	Soil group	Eq.
1 & 2	99	1	114
3	98	2	115
4	100	3	117
		4	124

## Comment:

26. One ton limestone per acre is approximately equivalent to 50 pounds per 1,000 square feet.
54. For all greens and tees, the 400 pounds N recommendation is the sum of approximately 10 four- to five-week applications of one pound of N per 1,000 square feet from soluble N sources. This may be supplied as three pounds ammonium nitrate (or equivalent) when N is supplied alone or as 8-8-8, 15-0-15, or other equivalent grades suggested when P<sub>2</sub>O<sub>5</sub> or K<sub>2</sub>O are recommended. Nitrogen applications should be alternated with application of other materials and modified to maintain desired growth and color. If slow release materials are used, rates and frequency of application may be modified.
55. Per 1,000 square feet apply eight pounds of 15-0-15 or equivalent low phosphorus fertilizer in the spring and repeat in the fall.
56. Per 1,000 square feet apply six pounds of 15-0-15 or equivalent low phosphorus fertilizer in the spring and repeat every two months for a total of four applications.
58. Per 1,000 square feet apply 14 pounds 13-13-13 or equivalent.
59. Per 1,000 square feet apply 14 pounds 13-13-13 or equivalent in the spring and six pounds in the fall.
60. Per 1,000 square feet apply 14 pounds 13-13-13 or equivalent in the spring and four applications of six pounds 15-0-15 at two-month intervals.
61. Per 1,000 square feet apply six pounds of superphosphate in the spring and repeat in the fall.
62. Per 1,000 square feet apply 14 pounds of 13-13-13 or equivalent in the spring and repeat in the fall.
63. Per 1,000 square feet apply 14 pounds of 13-13-13 or equivalent in the spring and repeat in the fall. Apply applications of six pounds 15-0-15 or equivalent low phosphorus fertilizer at two-month intervals.
64. Per 1,000 square feet apply 12 pounds of superphosphate or equivalent in the spring and repeat in the fall.
65. Per 1,000 square feet apply 12 pounds of superphosphate or equivalent in the spring to build up soil phosphorus. Apply 14 pounds of 8-8-8 or equivalent in the spring and repeat in the fall.
66. Per 1,000 square feet apply 14 pounds 13-13-13 or equivalent in the spring and at two-month intervals for four applications.



Golf Fairway

Phosphorus	Potassium				
	Very high	High	Medium	Low	Very low
Pounds N-P <sub>2</sub> O <sub>5</sub> -K <sub>2</sub> O per acre					
Very high ...	120- 0-0	120- 0-0	120- 0-40	120- 0-80	120- 0-80
High .....	120- 0-0	120- 0-0	120- 0-40	120- 0-80	120- 0-80
Medium .....	120-40-0	120-40-0	120-40-40	120-40-80	120-40-80
Low .....	120-80-0	120-80-0	120-80-40	120-80-80	120-80-80
Very low ....	120-80-0	120-80-0	120-80-40	120-80-80	120-80-80
K requirement level . . . . .	2		N rate . . . . . 120		
Lime code no. . . . .	5		PK code no . . . . . .12		
Mg code no. . . . .	1				

Fertilizer Recommendation Formula

P <sub>2</sub> O <sub>5</sub>		K <sub>2</sub> O	
Soil group	Eq.	Soil group	Eq.
1 & 2	14	1	17
3	13	2	19
4	15	3	20
		4	20

Comment:

67. On fairways, apply 60 pounds of N with the recommended rates of P<sub>2</sub>O<sub>5</sub> and K<sub>2</sub>O in the spring. Apply additional N as needed at the rate of 60 pounds per acre per application.

Athletic Field

Phosphorus	Potassium				
	Very high	High	Medium	Low	Very low
Pounds N-P <sub>2</sub> O <sub>5</sub> -K <sub>2</sub> O per acre					
Very high ..	200- 0-0	200- 0-0	200- 0-40	200- 0-80	200- 0-80
High .....	200- 0-0	200- 0-0	200- 0-40	200- 0-80	200- 0-80
Medium .....	200-40-0	200-40-0	200-40-40	200-40-80	200-40-80
Low .....	200-80-0	200-80-0	200-80-40	200-80-80	200-80-80
Very low ...	200-80-0	200-80-0	200-80-40	200-80-80	200-80-80
K requirement level . . . . .	2		N rate . . . . . 200		
Lime code no. . . . .	5		PK code no . . . . . .12		
Mg code no. . . . .	1				

Fertilizer Recommendation Formula

P <sub>2</sub> O <sub>5</sub>		K <sub>2</sub> O	
Soil group	Eq.	Soil group	Eq.
1 & 2	14	1	17
3	13	2	19
4	15	3	20
		4	20

Comment:

68. For athletic fields, nitrogen should be divided into four applications at two-month intervals beginning in March. Apply additional nitrogen at the rate of 50 pounds of N (150 pounds ammonium nitrate or equivalent) per acre if needed to maintain desired growth and color. A football field plus 20 feet on all sides is about two acres.

Roadside Turf Establishment

Phosphorus	Potassium				
	Very high	High	Medium	Low	Very low
	Pounds N-P <sub>2</sub> O <sub>5</sub> -K <sub>2</sub> O per acre				
Very high ..	120- 0-0	120- 0-40	120- 0-80	120- 0-160	120- 0-160
High .....	120- 40-0	120- 40-40	120- 40-80	120- 40-160	120- 40-160
Medium .....	120- 80-0	120- 80-40	120- 80-80	120- 80-160	120- 80-160
Low .....	120-160-0	120-160-40	120-160-80	120-160-160	120-160-160
Very low ...	120-160-0	120-160-40	120-160-80	120-160-160	120-160-160
K requirement level .....	2		N rate .....		
Lime code no. ....	1		PK code no .....		
Mg code no. ....	1				

Fertilizer Recommendation Formula

P <sub>2</sub> O <sub>5</sub>		K <sub>2</sub> O	
Soil group	Eq.	Soil group	Eq.
1 & 2	71	1	83
3	70	2	85
4	72	3	86
		4	97

Comment:

69. Before planting turf, mix recommended lime, phosphorus, potassium, and 80 pounds of N per acre into the surface soil before planting. One month after planting, apply 40 pounds of N per acre.  
 70. After establishing turf as recommended above, apply 40 pounds of N, P<sub>2</sub>O<sub>5</sub>, and K<sub>2</sub>O per acre at six-month intervals.

Roadside Turf Maintenance

Phosphorus	Potassium				
	Very high	High	Medium	Low	Very low
	Pounds N-P <sub>2</sub> O <sub>5</sub> -K <sub>2</sub> O per acre				
Very high	80- 0-0	80- 0-0	80- 0-40	80- 0-80	80- 0-80
High	80- 0-0	80- 0-0	80- 0-40	80- 0-80	80- 0-80
Medium	80-40-0	80-40-0	80-40-40	80-40-80	80-40-80
Low	80-80-0	80-80-0	80-80-80	80-80-80	80-80-80
Very low	80-80-0	80-80-0	80-80-80	80-80-80	80-80-80
K requirement level .....	2		N rate .....		
Lime code no. ....	1		PK code no .....		
Mg code no. ....	1				

Fertilizer Recommendation Formula

P <sub>2</sub> O <sub>5</sub>		K <sub>2</sub> O	
Soil group	Eq.	Soil group	Eq.
1 & 2	14	1	17
3	13	2	19
4	15	3	20
		4	20

RECOMMENDATIONS FOR GARDENS AND COMMERCIAL VEGETABLE CROPS

Crop Code No. 59

Organic Vegetable Garden  
(numbers refer to comments at bottom of page)

Phosphorous	Potassium				
	VH	H	M	L	VL
VH	1	1	1,2	1,2	1,2
H	3	3	4,5,2	4,5,2	4,5,2
M	6	6	6,2	6,2	6,2
L	6,7	6,7	6,7,2	6,7,2	6,7,2
VL	6,7	6,7	6,7,2	6,7,2	6,7,2

COMMENTS:

1. Soil analyses indicate very high or excessive P. Additional organic amendments will add more P. Use materials high in N but low in P such as cottonseed meal (6-3-1), fish meal (10-6-1), or blood meal (13-2-1). Legume cover crops can also provide some N to subsequent crops.
2. Organic materials generally provide less K compared to N and P. K can be supplied with "green sand" (6% K<sub>2</sub>O), or potassium magnesium sulfate (18% K<sub>2</sub>O, 11% Mg, 22% S). Apply enough material to supply one to three pounds K<sub>2</sub>O per 1,000 square feet.
3. Soil analyses indicate adequate K and P for most vegetables. To supply N for nonlegumes, use materials high in N but low in K such as cottonseed meal (6-3-1), fish meal (10-6-1), or blood meal (13-2-1). Legume cover crops can also provide some N to subsequent crops.
4. P is adequate for most crops.
5. To supply N for nonlegumes, use materials high in N but low in P such as cottonseed meal (6-3-1), fish meal (10-6-1), or blood meal (13-2-1). Legume cover crops can also provide some N to subsequent crops.
6. Most manures and composts will provide some N and P. Apply enough material to provide approximately three pounds N and three pounds P<sub>2</sub>O<sub>5</sub> per 1,000 square feet during the growing season.
7. Low soil P can be corrected by using bone meal (1-15-0) or rock phosphate (2-35% P<sub>2</sub>O<sub>5</sub>) to provide two to three pounds P<sub>2</sub>O<sub>5</sub> per 1,000 square feet.
8. Final comment. Most organic materials contain low levels of available nutrients. However, because large quantities are often used to build soil organic matter and improve soil physical characteristics, soil nutrients (i.e. P) often build to excessive levels. Nutrient availability (especially N) depends upon how fast the organic matter breaks down in the soil. Following are typical analyses (percent N-P<sub>2</sub>O<sub>5</sub>-K<sub>2</sub>O) of some common materials used as soil amendments in organically grown gardens:
 

fresh broiler litter (3-3-2)	composted broiler litter (2-3-1)
blood meal (13-2-1)	composted cow manure (1-2-1)
bone meal (1-15-0)	cottonseed meal (6-3-1)
fish meal (10-6-1)	wheat/oat straw (0-0-1)
legume hay (2-1-2)	composted yard waste (1-2-1)

Crop Code No. 60

Home Vegetable Garden

Phosphorus	Potassium				
	Very high	High	Medium	Low	Very low
	Pounds N-P <sub>2</sub> O <sub>5</sub> -K <sub>2</sub> O per acre				
Very high ...	120- 0-0 (72)	120- 0-60 (73)	120- 0-120 (74)	120- 0-180 (75)	120- 0-180 (75)
High .....	120- 60-0 (76)	120- 60-60 (77)	120- 60-120 (78)	120- 60-180 (79)	120- 60-180 (79)
Medium .....	120-120-0 (80)	120-120-60 (81)	120-120-120 (82)	120-120-180 (83)	120-120-180 (83)
Low .....	120-180-0 (84)	120-180-60 (85)	120-180-120 (86)	120-180-180 (87)	120-180-180 (87)
Very low ....	120-180-0 (84)	120-180-60 (85)	120-180-120 (86)	120-180-180 (87)	120-180-180 (87)

K requirement level . . . . . 2      N rate . . . . . 120  
 Lime code no. . . . . 1      PK code no . . . . . 21  
 Mg code no. . . . . 2

Fertilizer Recommendation Formula

P <sub>2</sub> O <sub>5</sub>		K <sub>2</sub> O	
Soil group	Eq.	Soil group	Eq.
1 & 2	94	1	101
3	91	2	103
4	95	3	105
		4	110

Comment:

- 26. One ton limestone per acre is approximately equivalent to 50 pounds per 1,000 square feet.
- 71. For cauliflower, broccoli, and root crops on sandy soils apply one pound boron (B) per acre. (For home gardens, one tablespoon borax per 100 feet of row) For corn in home gardens on sandy soils apply one tablespoon zinc sulfate per 100 feet of row.
- 72. Per 100 feet of row apply 0.4 pound N (one pint ammonium nitrate) at planting and sidedress with 0.4 pound N.
- 73. Per 1,000 square feet broadcast 2.3 pounds muriate of potash (one quart). Per 100 feet of row apply 0.4 pound N (one pint ammonium nitrate) at planting and sidedress with 0.4 pound N.
- 74. Per 1,000 square feet broadcast 4.6 pounds muriate of potash (two quarts). Per 100 feet of row apply 0.4 pound N (one pint ammonium nitrate) at planting and sidedress with 0.4 pound N.
- 75. Per 1,000 square feet broadcast seven pounds muriate of potash (three quarts). Per 100 feet of row apply 0.4 pound N (one pint ammonium nitrate) at planting and sidedress with 0.4 pound N.
- 76. Per 1,000 square feet broadcast 7.5 pounds superphosphate (four quarts). Per 100 feet of row apply 0.4 pound N (one pint ammonium nitrate) at planting and sidedress with 0.4 pound N.
- 77. Per 100 feet of row apply five pounds of 13-13-13 (2.5 quarts) at planting and sidedress with 0.4 pound N (one pint ammonium nitrate).
- 78. Per 1,000 square feet broadcast 2.3 pounds muriate of potash (one quart). Per 100 feet of row apply three pounds 13-13-13 (1 1/2 quarts) at planting and sidedress with 0.4 pound N (one pint ammonium nitrate).
- 79. Per 1,000 square feet broadcast 4.6 pounds muriate of potash (two quarts). Per 100 feet of row apply three pounds 13-13-13 (1.5 quarts) at planting and sidedress with 0.4 pound N (one pint ammonium nitrate).
- 80. Per 1,000 square feet broadcast 15.0 pounds superphosphate (eight quarts). Per 100 feet row apply three pounds 13-13-13 (1.5 quarts) at planting and sidedress with 0.4 pound N.
- 81. Per 1,000 square feet broadcast 7.5 pounds superphosphate (four quarts). Per 100 feet of row apply three pounds 13-13-13 (1.5 quarts) at planting and sidedress with 0.4 pound N (one pint ammonium nitrate).
- 82. Per 100 feet of row apply four pounds 13-13-13 (two quarts) at planting and sidedress with 2.5 pounds 13-13-13 (five cups).
- 83. Per 1,000 square feet broadcast 2.3 pounds muriate of potash (one quart). Per 100 feet of row apply four pounds 13-13-13 (two quarts) at planting and sidedress with 2.5 pounds 13-13-13 (five cups).
- 84. Per 1,000 square feet broadcast 20 pounds superphosphate (11 quarts). Per 100 feet of row apply 0.4 pound N (one pint ammonium nitrate) at planting and sidedress with 0.4 pound N.
- 85. Per 1,000 square feet broadcast 7.5 pounds superphosphate (4 quarts). Per 100 feet of row apply four pounds 13-13-13 (two quarts) at planting and sidedress with 0.4 pound N (one pint ammonium nitrate).
- 86. Per 1,000 square feet broadcast 7.5 pounds superphosphate (four quarts). Per 100 feet of row apply four pounds 13-13-13 (two quarts) at planting and sidedress with 2.5 pounds 13-13-13 (five cups).
- 87. Per 1,000 square feet broadcast 35 pounds 4-12-12 at planting. Per 100 feet of row sidedress with 0.4 pound N (one pint ammonium nitrate).
- 88. For strawberries apply about one-third of the fertilizer in September, one-third about 90 days before ripening and one-third after harvest.
- 112. Final remark. For small areas, comments give examples of ways to meet the fertilizer recommendations. Other fertilizer grades or materials that supply equivalent amounts of plant nutrients may be used with equal results. If you need assistance in calculating amounts of other materials to use contact your county agent or fertilizer supplier.

Commercial Vegetable Crops

Phosphorus	Potassium				
	Very high	High	Medium	Low	Very low
	Pounds N-P <sub>2</sub> O <sub>5</sub> -K <sub>2</sub> O per acre				
Very high ...	120- 0-0	120- 0-60	120- 0-120	120- 0-180	120- 0-180
High .....	120- 60-0	120- 60-60	120- 60-120	120- 60-180	120- 60-180
Medium .....	120-120-0	120-120-60	120-120-120	120-100-180	120-120-180
Low .....	120-180-0	120-180-60	120-180-120	120-180-180	120-180-180
Very low ....	120-180-0	120-180-60	120-180-120	120-180-180	120-180-180

K requirement level . . . . . 2      N rate . . . . . 120  
 Lime code no. . . . . 1      PK code no . . . . . 18  
 Mg code no. . . . . 2

Fertilizer Recommendation Formula

P <sub>2</sub> O <sub>5</sub>		K <sub>2</sub> O	
Soil group	Eq.	Soil group	Eq.
1 & 2	94	1	101
3	91	2	103
4	95	3	105
		4	110

Comment:

100. For cauliflower, broccoli, and root crops, apply one pound of B per acre.

Tomatoes

Phosphorus	Potassium				
	Very high	High	Medium	Low	Very low
	Pounds N-P <sub>2</sub> O <sub>5</sub> -K <sub>2</sub> O per acre				
Very high ...	120- 0-0	120- 0-60	120- 0-120	120- 0-180	120- 0-180
High .....	120- 60-0	120- 60-60	120- 60-120	120- 60-180	120- 60-180
Medium .....	120-120-0	120-120-60	120-120-120	120-120-180	120-120-180
Low .....	120-180-0	120-180-60	120-180-120	120-180-180	120-180-180
Very low ....	120-180-0	120-180-60	120-180-120	120-180-180	120-180-180

K requirement level . . . . . 2      N rate . . . . . 120  
 Lime code no. . . . . 2      PK code no . . . . . 18  
 Mg code no. . . . . 2

Fertilizer Recommendation Formula

P <sub>2</sub> O <sub>5</sub>		K <sub>2</sub> O	
Soil group	Eq.	Soil group	Eq.
1 & 2	94	1	101
3	91	2	103
4	95	3	105
		4	110

Comment:

89. Apply 1,000 pounds of gypsum per acre to tomatoes before planting. (Where Ca is rated low and no lime is recommended.)

90. Apply 500 pounds of gypsum per acre to tomatoes before planting. (Where Ca is rated medium and no lime is recommended.)

## Sweet Potatoes

Phosphorus	Potassium				
	Very high	High	Medium	Low	Very low
Pounds N-P <sub>2</sub> O <sub>5</sub> -K <sub>2</sub> O per acre					
Very high ...	80- 0-0	80- 0-80	80- 0-120	80- 0-160	80- 0-200
High .....	80- 40-0	80- 40-80	80- 40-120	80- 40-160	80- 40-200
Medium .....	80- 80-0	80- 80-80	80- 80-120	80- 80-160	80- 80-200
Low .....	80-120-0	80-120-80	80-120-120	80-120-160	80-120-200
Very low .....	80-160-0	80-160-80	80-160-120	80-160-160	80-160-200
K requirement level .....	2		N rate .....		
Lime code no. ....	1		PK code no. ....		
Mg code no. ....	2		.80 .24		

## Fertilizer Recommendation Formula

P <sub>2</sub> O <sub>5</sub>		K <sub>2</sub> O	
Soil group	Eq.	Soil group	Eq.
1 & 2	67	1	102
3	66	2	104
4	68	3	106
		4	110

## Irish Potatoes

Phosphorus	Potassium				
	Very high	High	Medium	Low	Very low
Pounds N-P <sub>2</sub> O <sub>5</sub> -K <sub>2</sub> O per acre					
Very high ...	120- 50-0	120- 50-100	120- 50-150	120- 50-200	120- 50-200
High .....	120-100-0	120-100-100	120-100-150	120-100-200	120-100-200
Medium .....	120-150-0	120-150-100	120-150-150	120-150-200	120-150-200
Low .....	120-200-0	120-200-100	120-200-150	120-200-200	120-200-200
Very low .....	120-200-0	120-200-100	120-200-150	120-200-200	120-200-200
K requirement level .....	2		N rate .....		
Lime code no. ....	4		PK code no. ....		
Mg code no. ....	3		120 .17		

## Fertilizer Recommendation Formula

P <sub>2</sub> O <sub>5</sub>		K <sub>2</sub> O	
Soil group	Eq.	Soil group	Eq.
1 & 2	108	1	116
3	107	2	118
4	109	3	119
		4	125

## Comment:

98. Where Irish potatoes are grown in rotation with other crops, follow lime recommendation for Irish potatoes.

Crop Code No. 65

Watermelons, Cantaloupes, Cucumbers, Lima Beans,  
Snap Bunch Beans, Squash, and Okra

Phosphorus	Potassium				
	Very high	High	Medium	Low	Very low
	Pounds N-P <sub>2</sub> O <sub>5</sub> -K <sub>2</sub> O per acre				
Very high ...	80- 0-0	80- 0-40	80- 0-80	80- 0-120	80- 0-120
High .....	80- 40-0	80- 40-40	80- 40-80	80- 40-120	80- 40-120
Medium .....	80- 80-0	80- 80-40	80- 80-80	80- 80-120	80- 80-120
Low .....	80-120-0	80-120-40	80-120-80	80-120-120	80-120-120
Very low ....	80-120-0	80-120-40	80-120-80	80-120-120	80-120-120
K requirement level . . . . .	2		N rate . . . . . .80		
Lime code no. . . . .	1		PK code no . . . . . .19		
Mg code no. . . . .	2				

Fertilizer Recommendation Formula

P <sub>2</sub> O <sub>5</sub>		K <sub>2</sub> O	
Soil group	Eq.	Soil group	Eq.
1 & 2	47	1	61
3	44	2	64
4	50	3	65
		4	65

Crop Code No. 66

Sweet Corn

Phosphorus	Potassium				
	Very high	High	Medium	Low	Very low
	Pounds N-P <sub>2</sub> O <sub>5</sub> -K <sub>2</sub> O per acre				
Very high ...	150- 0-0	150- 0-0	150- 0-60	150- 0-100	150- 0-120
High .....	150- 0-0	150- 0-0	150- 0-60	150- 0-100	150- 0-120
Medium .....	150- 60-0	150- 60-0	150- 60-60	150- 60-100	150- 60-120
Low .....	150-100-0	150-100-0	150-100-60	150-100-100	150-100-120
Very low ....	150-120-0	150-120-0	150-120-60	150-120-100	150-120-120
K requirement level . . . . .	2		N rate . . . . . .150		
Lime code no. . . . .	1		PK code no . . . . . .2		
Mg code no. . . . .	2				

Fertilizer Recommendation Formula

P <sub>2</sub> O <sub>5</sub>		K <sub>2</sub> O	
Soil group	Eq.	Soil group	Eq.
1 & 2	43	1	48
3	42	2	52
4	45	3	54
		4	64

Comment:

91. Apply three pounds of Zn per acre in corn fertilizer.

Pepper, Pimiento

Phosphorus	Potassium				
	Very high	High	Medium	Low	Very low
	Pounds N-P <sub>2</sub> O <sub>5</sub> -K <sub>2</sub> O per acre				
Very high ...	100- 0-0	100- 0-60	100- 0-120	100- 0-180	100- 0-180
High .....	100- 60-0	100- 60-60	100- 60-120	100- 60-180	100- 60-180
Medium .....	100-120-0	100-120-60	100-120-120	100-120-180	100-120-180
Low .....	100-180-0	100-180-60	100-180-120	100-180-180	100-180-180
Very low ....	100-180-0	100-180-60	100-180-120	100-180-180	100-180-180

K requirement level . . . . . 2                      N rate . . . . . 100  
 Lime code no. . . . . 2                                  PK code no . . . . . 18  
 Mg code no. . . . . 2

Fertilizer Recommendation Formula

P <sub>2</sub> O <sub>5</sub>		K <sub>2</sub> O	
Soil group	Eq.	Soil group	Eq.
1 & 2	94	1	101
3	91	2	103
4	95	3	105
		4	110



RECOMMENDATIONS FOR SHRUBS AND FLOWERS

Crop Code No. 80

Shrubs and Perennial Flowers

	Potassium				
	Very high	High	Medium	Low	Very low
	Pounds N-P <sub>2</sub> O <sub>5</sub> -K <sub>2</sub> O per acre				
Very high ...	120- 0-0 (92)	120- 0-0 (92)	120- 0-60 (93)	120- 0-120 (94)	120- 0-120 (94)
High .....	120- 0-0 (92)	120- 0-0 (92)	120- 0-60 (93)	120- 0-120 (94)	120- 0-120 (94)
Medium .....	120- 60-0 (115)	120- 60-0 (115)	120- 60-60 (95)	120- 60-120 (96)	120- 60-120 (96)
Low .....	120-120-0 (97)	120-120-0 (97)	120-120-60 (116)	120-120-120 (99)	120-120-120 (99)
Very low ....	120-120-0 (97)	120-120-0 (97)	120-120-60 (116)	120-120-120 (99)	120-120-120 (99)

K requirement level . . . . . 2      N rate . . . . . 120  
 Lime code no. . . . . 1      PK code no . . . . . 16  
 Mg code no. . . . . 2

Fertilizer Recommendation Formula

P <sub>2</sub> O <sub>5</sub>		K <sub>2</sub> O	
Soil group	Eq.	Soil group	Eq.
1 & 2	56	1	59
3	54	2	61
4	56	3	63
		4	69

Comment:

- 26. One ton limestone per acre is approximately equivalent to 50 pounds per 1,000 square feet.
- 92. Per 100 square feet apply one cup ammonium nitrate or equivalent in early spring and repeat in early summer.
- 93. Per 100 square feet apply one pint 15-0-15 or equivalent in early spring and then apply one cup ammonium nitrate or equivalent in early summer.
- 94. Per 100 square feet apply one pint 15-0-15 or equivalent in early spring and repeat in early summer.
- 95. Per 100 square feet apply one quart 8-8-8 or equivalent in early spring and then apply one cup ammonium nitrate or equivalent in early summer.
- 96. Per 100 square feet apply one quart 8-8-8 or equivalent in early spring and then apply one pint 15-0-15 in early summer.
- 97. Per 100 square feet apply 1.5 pints superphosphate or equivalent and one cup ammonium nitrate or equivalent in early spring and then apply one cup ammonium nitrate in early summer.
- 99. Per 100 square feet apply one quart 8-8-8 or equivalent in early spring and repeat in early summer.
- 115. Per 100 square feet apply three-fourths pint superphosphate or equivalent plus one cup ammonium nitrate or equivalent in early spring then one cup ammonium nitrate or equivalent in early summer.
- 116. Per 100 square feet apply three-fourths pint superphosphate or equivalent plus one quart 8-8-8 or equivalent in early spring then apply one cup ammonium nitrate or equivalent in early summer.
- 112. Final remark. For small areas, comments give examples of ways to meet the fertilizer recommendations. Other fertilizer grades or materials that supply equivalent amounts of plant nutrients may be used with equal results. If you need assistance in calculating amounts of other materials to use contact your county agent or fertilizer supplier.
- 117. Shrubs-Final remark on liming. For shrubs such as azaleas, gardenias, and rhododendron, which require acid soil do not apply lime. If the pH is below 5.0 you may wish to check with your county agent concerning the advisability of using a reduced rate of lime for these shrubs.

Azaleas, Gardenias, and Rhododendrons

Phosphorus	Potassium				
	Very high	High	Medium	Low	Very low
	Pounds N-P <sub>2</sub> O <sub>5</sub> -K <sub>2</sub> O per acre				
Very high ...	120- 0-0 (92)	120- 0-0 (92)	120- 0-60 (93)	120- 0-120 (94)	120- 0-120 (94)
High .....	120- 0-0 (92)	120- 0-0 (92)	120- 0-60 (93)	120- 0-120 (94)	120- 0-120 (94)
Medium .....	120- 60-0 (115)	120- 60-0 (115)	120- 60-60 (95)	120- 60-120 (96)	120- 60-120 (96)
Low .....	120-120-0 (97)	120-120-0 (97)	120-120-60 (116)	120-120-120 (99)	120-120-120 (99)
Very low ....	120-120-0 (97)	120-120-0 (97)	120-120-60 (116)	120-120-120 (99)	120-120-120 (99)

K requirement level . . . . .	2	N rate . . . . .	120
Lime code no. . . . .	0	PK code no . . . . .	.16
Mg code no. . . . .	2		

Fertilizer Recommendation Formula

P <sub>2</sub> O <sub>5</sub>		K <sub>2</sub> O	
Soil group	Eq.	Soil group	Eq.
1 & 2	56	1	59
3	54	2	61
4	56	3	63
		4	69

Roses, Mums, and Annual Flowers

Phosphorus	Potassium				
	Very high	High	Medium	Low	Very low
Pounds N-P <sub>2</sub> O <sub>5</sub> -K <sub>2</sub> O per acre					
Very high ...	120- 0-0 (103)	120- 0-0 (103)	120- 0-60 (104)	120- 0-120 (105)	120- 0-120 (105)
High .....	120- 0-0 (103)	120- 0-0 (103)	120- 0-60 (104)	120- 0-120 (105)	120- 0-120 (105)
Medium .....	120- 60-0 (102)	120- 60-0 (102)	120- 60-60 (106)	120- 60-120 (107)	120- 60-120 (107)
Low .....	120-120-0 (108)	120-120-0 (108)	120-120-60 (109)	120-120-120 (110)	120-120-120 (110)
Very low ....	120-120-0 (108)	120-120-0 (108)	120-120-60 (109)	120-120-120 (110)	120-120-120 (110)

K requirement level . . . . . 2                      N rate . . . . . 120  
 Lime code no. . . . . 1                              PK code no . . . . . 16  
 Mg code no. . . . . 2

Fertilizer Recommendation Formula

P <sub>2</sub> O <sub>5</sub>		K <sub>2</sub> O	
Soil group	Eq.	Soil group	Eq.
1 & 2	56	1	59
3	55	2	61
4	57	3	63
		4	69

Comment:

26. One ton limestone per acre is approximately equivalent to 50 pounds per 1,000 square feet. 102. Per 100 square feet apply three-fourth pint superphosphate or equivalent and one-half cup ammonium nitrate or equivalent when spring growth begins.

Repeat at the ammonium nitrate application monthly until August 1.

103. Per 100 square feet apply one-half cup ammonium nitrate or equivalent when spring growth begins and repeat monthly until August 1. If P is excessive then fertilizers containing this element should not be used. Excessive P may cause an Fe deficiency. The symptoms occur as a general yellowing of new growth. To correct, spray with a soluble source of Fe, which can be found at garden supply stores.

104. Per 100 square feet apply alternately one cup 15-0-15 or equivalent and one-half cup ammonium nitrate or equivalent monthly starting when spring growth begins. Make last application about August 1. If P is excessive, then fertilizers containing this element could not be used. Excessive P may cause an Fe deficiency. The symptoms occur as a general yellowing of new growth. To correct, spray with a soluble source of Fe, which can be found at garden supply stores.

105. Per 100 square feet apply one cup 15-0-15 when spring growth begins and repeat monthly until August 1. If P is excessive then fertilizers containing this element should not be used. Excessive P may cause an Fe deficiency. The symptoms occur as a general yellowing of new growth. To correct, spray with a soluble source of iron which can be found at garden supply stores.

106. Per 100 square feet apply two cups 8-8-8 and one-half cup ammonium nitrate or equivalent at monthly intervals starting when spring growth begins. Make last application about August 1.

107. Per 100 square feet apply two cups 8-8-8 or equivalent and one cup 15-0-15 or equivalent at monthly intervals starting when spring growth begins. Make last application about August 1.

108. Per 100 square feet apply 1.5 pints superphosphate or equivalent, apply one-half cup ammonium nitrate or equivalent when spring growth begins and repeat ammonium nitrate application monthly until August 1.

109. Per 100 square feet apply one cup superphosphate or equivalent as corrective treatment. Then apply alternately two cups 8-8-8 and one-half cup ammonium nitrate or equivalent at monthly intervals starting when spring growth begins. Make the last application about August 1.

110. Per 100 square feet apply 1.5 cups 8-8-8 or equivalent when spring growth begins and repeat monthly until August 1.

112. Final remark. For small areas, comments give examples of ways to meet the fertilizer recommendations. Other fertilizer grades or materials that supply equivalent amounts of plant nutrients may be used with equal results. If you need assistance in calculating amounts of other materials to use contact your county agent or fertilizer supplier.

Crop Code No. 84

This crop code is primarily used for potting soil. The computer prints pounds per acre of soil-test P, K, Ca, and Mg. It also gives the soil pH and the lime requirement to bring the soil pH up to 6.5. Spaces are also printed in which soluble salts and nitrates are recorded by hand. Generally all reports that receive crop code 84 are sent to the Extension horticulture specialist for fertilizer and lime recommendations.

Crop Code No. 85

Christmas Trees (Cedar, Va. Pines,  
Pines, Arizona Cyprus)

Phosphorus	Potassium				
	Very high	High	Medium	Low	Very low
	Pounds N-P <sub>2</sub> O <sub>5</sub> -K <sub>2</sub> O per acre				
Very high .....	*- 0-0	*- 0-0	*- 0-40	*- 0-60	*- 0-80
High .....	*- 0-0	*- 0-0	*- 0-40	*- 0-60	*- 0-80
Medium .....	*-40-0	*-40-0	*-40-40	*-40-60	*-40-80
Low .....	*-60-0	*-60-0	*-60-40	*-60-60	*-60-80
Very low .....	*-80-0	*-80-0	*-80-40	*-80-60	*-80-80
K requirement level . . . . .	1		N rate . . . . . *		
Lime code no. . . . .	4		PK code no . . . . . 4		
Mg code no. . . . .	3				

Fertilizer Recommendation Formula

P <sub>2</sub> O <sub>5</sub>		K <sub>2</sub> O	
Soil group	Eq.	Soil group	Eq.
1 & 2	5	1	7
3	4	2	9
4	6	3	11
		4	12

Comment:

172. Christmas trees - Final remark. Apply dolomitic lime and P and K fertilizer as recommended and work into the soil before planting. After the first year, make applications of up to 30 pounds N per acre as needed to give desired growth.

RECOMMENDATIONS FOR FRUITS AND NUTS

Crop Code No. 89

Strawberries

Phosphorus	Potassium				
	Very high	High	Medium	Low	Very low
	Pounds N-P <sub>2</sub> O <sub>5</sub> -K <sub>2</sub> O per acre				
Very high ...	120- 0-0	120- 0-60	120- 0-120	120- 0-180	120- 0-180
High .....	120- 60-0	120- 60-60	120- 60-120	120- 60-180	120- 60-180
Medium .....	120-120-0	120-120-60	120-120-120	120-120-180	120-120-180
Low .....	120-180-0	120-180-60	120-180-120	120-180-180	120-180-180
Very low ....	120-180-0	120-180-60	120-180-120	120-180-180	120-180-180
K requirement level . . . . .	2		N rate . . . . . 120		
Lime code no. . . . .	1		PK code no . . . . . .18		
Mg code no. . . . .	2				

Fertilizer Recommendation Formula

P <sub>2</sub> O <sub>5</sub>		K <sub>2</sub> O	
Soil group	Eq.	Soil group	Eq.
1 & 2	94	1	101
3	91	2	103
4	95	3	105
		4	110

Comment:

88. Matted Row System (established plantings):

At renovation just as soon as the plants stop fruiting apply 40 to 50 pounds N, apply 30 to 45 pounds N late August or early September. A 20-pound N topdressing in February may be useful in sandy soils.

Annual Hill Plasticulture System:

Plants require about 150 pounds N for the entire production season with approximately one-third (about 50 pounds N) being applied dry preplant in the beds. The remaining two-thirds (approximately 100 pounds N) is supplied by injection through the drip irrigation system. About 50 to 100% of the K and all recommended P are applied preplant. K can be injected along with N.

Peaches

Phosphorus	Potassium				
	Very high	High	Medium	Low	Very low
	Pounds N-P <sub>2</sub> O <sub>5</sub> -K <sub>2</sub> O per acre				
Very high ...	*- 0-0	*- 0-0	*- 0-30	*- 0-60	*- 0-90
High .....	*- 0-0	*- 0-0	*- 0-30	*- 0-60	*- 0-90
Medium .....	*-30-0	*-30-0	*-30-30	*-30-60	*-30-90
Low .....	*-60-0	*-60-0	*-60-30	*-60-60	*-60-90
Very low ....	*-60-0	*-60-0	*-60-30	*-60-60	*-60-90
K requirement level . . . . .	1		N rate . . . . . *		
Lime code no. . . . .	2		PK code no . . . . . .20		
Mg code no. . . . .	2				

Fertilizer Recommendation Formula

P <sub>2</sub> O <sub>5</sub>		K <sub>2</sub> O	
Soil group	Eq.	Soil group	Eq.
1 & 2	2	1	6
3	1	2	8
4	3	3	10
		4	20

Comment:

114. Peaches - Final remark. For establishing new orchards, apply lime and P and K fertilizer as recommended and turn to a depth of 12 to 16 inches, then repeat the application and disk into the topsoil. Broadcast 20 to 25 pounds Zn (50 to 70 pounds 36% Zn sulfate) per acre and disk into topsoil when establishing new plantings. No soil applications of zinc are usually needed on old orchard or crop land. Maintain soil pH at about 6.5 by reliming as needed by soil test.

For annual maintenance apply P and K fertilizer as recommended. For the first and second leaf apply 0.08 pound N (four ounces ammonium nitrate or equivalent) per tree per year of age about February 15, then repeat two or three times at six-week intervals beginning at initiation of new growth. In third leaf apply 0.6 pound N (1.75 pounds ammonium nitrate) per tree, in fourth leaf apply 0.8 pound N (2.33 pounds ammonium nitrate), and in fifth leaf or older apply one pound N (three pounds ammonium nitrate) per tree. Beginning in third leaf apply two-thirds of the N in February and one-third of the N after harvest.

Muscadine Grapes

Phosphorus	Potassium				
	Very high	High	Medium	Low	Very low
	Pounds N-P <sub>2</sub> O <sub>5</sub> -K <sub>2</sub> O per acre				
Very high ...	*- 0-0	*- 0-0	*- 0-30	*- 0-60	*- 0-90
High .....	*- 0-0	*- 0-0	*- 0-30	*- 0-60	*- 0-90
Medium .....	*-30-0	*-30-0	*-30-30	*-30-60	*-30-90
Low .....	*-60-0	*-60-0	*-60-30	*-60-60	*-60-90
Very low .....	*-60-0	*-60-0	*-60-30	*-60-60	*-60-90

K requirement level . . . . .	1	N rate . . . . .	*
Lime code no. . . . .	2	PK code no . . . . .	.20
Mg code no. . . . .	2		

Fertilizer Recommendation Formula

P <sub>2</sub> O <sub>5</sub>		K <sub>2</sub> O	
Soil group	Eq.	Soil group	Eq.
1 & 2	2	1	6
3	1	2	8
4	3	3	10
		4	20

Comment:

124. Muscadine grapes - Final remark. Apply P and K as recommended above and maintain pH in range of 6.0 to 7.0 by liming as needed according to soil test.

N should be applied as follows: In first and second year apply 0.04 pound N (two ounces ammonium nitrate) per plant per year of age in February and repeat in May and early July.

In third year apply 0.16 pound N (one-half pound ammonium nitrate) per plant in March and repeat in late May after fruit set.

In fourth year and later apply 0.32 pound N (one pound ammonium nitrate) in March and 0.16 pound N per plant per year of age in late May up to a maximum application of 0.55 pound N per plant or 100 pounds N per acre.

Apples and Pears

Phosphorus	Potassium				
	Very high	High	Medium	Low	Very low
	Pounds N-P <sub>2</sub> O <sub>5</sub> -K <sub>2</sub> O per acre				
Very high ...	*- 0-0	*- 0-0	*- 0-30	*- 0-60	*- 0-90
High .....	*- 0-0	*- 0-0	*- 0-30	*- 0-60	*- 0-90
Medium .....	*-30-0	*-30-0	*-30-30	*-30-60	*-30-90
Low .....	*-60-0	*-60-0	*-60-30	*-60-60	*-60-90
Very low .....	*-60-0	*-60-0	*-60-30	*-60-60	*-60-90

K requirement level . . . . .	1	N rate . . . . .	*
Lime code no. . . . .	2	PK code no . . . . .	.20
Mg code no. . . . .	2		

Fertilizer Recommendation Formula

P <sub>2</sub> O <sub>5</sub>		K <sub>2</sub> O	
Soil group	Eq.	Soil group	Eq.
1 & 2	2	1	6
3	1	2	8
4	3	3	10
		4	20

Comment:

125. Apples - Final remark. For establishing new orchards, apply lime and P and K fertilizer as recommended and turn to depth of 12 to 16 inches, then repeat the application and disk into topsoil. Maintain soil pH in range of 6.0 to 7.0 by reliming as needed by soil test.

For annual maintenance apply P and K fertilizer as recommended. For young trees apply 0.1 pound N (10 ounces calcium nitrate) per tree and for 10 years or older trees apply 35 pounds N per acre. (Calcium nitrate is recommended as a source of N for apple.)

Zinc: To correct Zn deficiency in apples apply 0.08 pound Zn (0.24 pound zinc sulfate) per tree. Broadcast 20 to 25 pounds Zn (50-70 pounds 36% zinc sulfate) per acre and disk into topsoil when establishing new plantings. No soil applications of zinc are usually needed on old orchard or crop land.

Boron: Make two sprays using one pound Solubor per 100 gallons of water. Begin at petal fall and repeat two weeks later. If B sprays are not used, make a soil application of two pounds B per acre annually.

Calcium: Make four sprays using either three pounds calcium nitrate or two pounds calcium chloride per 100 gallons of water. Begin two weeks after petal fall and repeat three times at two-week intervals.

For bitter pit: If calcium sprays are not made in early spring they should be applied as recommended above beginning eight weeks prior to anticipated harvest.

Plums

	Potassium				
	Very high	High	Medium	Low	Very low
Phosphorus	Pounds N-P <sub>2</sub> O <sub>5</sub> -K <sub>2</sub> O per acre				
Very high ...	*- 0-0	*- 0-0	*- 0-30	*- 0-60	*- 0-90
High .....	*- 0-0	*- 0-0	*- 0-30	*- 0-60	*- 0-90
Medium .....	*-30-0	*-30-0	*-30-30	*-30-60	*-30-90
Low .....	*-60-0	*-60-0	*-60-30	*-60-60	*-60-90
Very low ....	*-60-0	*-60-0	*-60-30	*-60-60	*-60-90
K requirement level . . . . .	1		N rate . . . . . *		
Lime code no. . . . .	2		PK code no . . . . . 20		
Mg code no. . . . .	2				

Fertilizer Recommendation Formula

P <sub>2</sub> O <sub>5</sub>		K <sub>2</sub> O	
Soil group	Eq.	Soil group	Eq.
1 & 2	2	1	6
3	1	2	8
4	3	3	10
		4	20

Comment:

135. Plums - Final remark. For establishing new orchards, apply lime and P and K fertilizer as recommended and turn to a depth of 12 to 16 inches, then repeat the application and disk into the topsoil. Broadcast 20 to 25 pounds Zn (50 to 70 pounds 36% zinc sulfate) per acre and disk into topsoil when establishing new plantings. No soil applications of zinc are usually needed on old orchard or crop land.

For annual maintenance apply P and K fertilizer as recommended. For the first and second leaf apply 0.08 pound N (4 ounces ammonium nitrate or equivalent) per tree per year of age about February 15, then repeat two or three times at six-week intervals beginning at initiation of new growth. In third leaf apply 0.6 pound N (1.75 pounds ammonium nitrate) per tree, in four pounds ammonium nitrate) per tree. Beginning in third leaf apply two-third of the N in February and one-third of the N after harvest. If borated fertilizer is not used to supply boron, apply one pound B per acre or five tablespoons borax per tree.



Pecans

Phosphorus	Potassium				
	Very high	High	Medium	Low	Very low
	Pounds N-P <sub>2</sub> O <sub>5</sub> -K <sub>2</sub> O per acre				
Very high ...	*- 0-0	*- 0-0	*- 0-30	*- 0-60	*- 0-90
High .....	*- 0-0	*- 0-0	*- 0-30	*- 0-60	*- 0-90
Medium .....	*-30-0	*-30-0	*-30-30	*-30-60	*-30-90
Low .....	*-60-0	*-60-0	*-60-30	*-60-60	*-60-90
Very low ....	*-60-0	*-60-0	*-60-30	*-60-90	*-60-90
K requirement level . . . . .	1		N rate . . . . . *		
Lime code no. . . . .	2		PK code no . . . . . .20		
Mg code no. . . . .	2				

Fertilizer Recommendation Formula

P <sub>2</sub> O <sub>5</sub>		K <sub>2</sub> O	
Soil group	Eq.	Soil group	Eq.
1 & 2	2	1	6
3	1	2	8
4	3	3	10
		4	20

Comment:

136. Pecans - Final remark. Apply P and K as recommended above. For trees 20 years old or more apply six to eight pounds N (20 to 25 pounds ammonium nitrate or equivalent) per tree or 100 pounds N per acre broadcast in February. For younger trees apply one-half pound of N (1.5 pounds ammonium nitrate or equivalent) per tree per year of age. For trees four years and older showing zinc deficiency apply 35 to 50 pounds of Zn (100 to 140 pounds 36% Zn sulfate) per acre and disk into topsoil to about six inches. In addition, apply two to four foliar sprays of zinc sulfate at the rate of two to four pounds per 100 gallons of water during April and early May the first year after soil application. Thereafter, monitor Zn leaf levels by leaf analysis. For younger trees apply one-fourth pound of Zn per tree per year of tree age and work into soil. Full benefit from fertilization will not be obtained unless a good spray program for disease and insect control is followed.

Home Orchard

Phosphorus	Potassium				
	Very high	High	Medium	Low	Very low
	Pounds N-P <sub>2</sub> O <sub>5</sub> -K <sub>2</sub> O per acre				
Very high ...	*- 0- 0 (158)	*- 0- 0 (158)	*- 0-50 (159)	*- 0-50 (159)	*- 0-50 (159)
High .....	*- 0- 0 (158)	*- 0- 0 (158)	*- 0-50 (159)	*- 0-50 (159)	*- 0-50 (159)
Medium .....	*-50- 0 (160)	*-50-50 (161)	*-50-50 (161)	*-50-50 (161)	*-50-50 (161)
Low .....	*-50-50 (161)	*-50-50 (161)	*-50-50 (161)	*-50-50 (161)	*-50-50 (161)
Very low ....	*-50-50 (161)	*-50-50 (161)	*-50-50 (161)	*-50-50 (161)	*-50-50 (161)
K requirement level . . . . .	2		N rate . . . . . *		
Lime code no. . . . .	2		PK code no . . . . . .23		
Mg code no. . . . .	2				

Comment:

- 26. One ton limestone per acre is approximately equivalent to 50 pounds per 1,000 square feet.
- 158. No P or K needed. Apply N for individual trees as recommended below.
- 159. Per 1,000 square feet apply two pounds muriate of potash then apply N of individual trees as recommended below.
- 160. Per 1,000 square feet apply six pounds 20% superphosphate or equivalent. Apply N for individual plants as recommended below.
- 161. Per 1,000 square feet apply eight pounds 0-14-14. Apply N for individual trees as recommended below.
- 162. Home orchards - Final remark. Apply nitrogen for individual plants as follows:
  - Peaches, plums, pecans: Apply 0.16 pound N (one-half pound ammonium nitrate) per plant per year of age up to a maximum of one pound N per tree for peaches, 0.8 pound N per tree for plums, and 10 pounds N per tree for pecans.
  - Pears: Apply 0.06 pound N (0.2 ammonium nitrate) per tree per year of age up to a maximum of 0.56 pound N per tree.
  - Apples: Apply 0.08 pound N (one-fourth pound ammonium nitrate) per plant per year of age up to a maximum of 0.56 pound N per plant.
  - Figs, grapes: Apply 0.04 pound N (0.12 pound ammonium nitrate) per plant per year of age up to a maximum of 0.56 pound per plant.
  - Strawberries: Apply 0.3 pound N (one pound ammonium nitrate) per 100 feet of row in October; repeat 90 days before ripening and again after harvest.
  - Blackberries: Apply one to 1.3 pounds N (three to four pounds ammonium nitrate) per 100 feet of row in February and one- and 1.5 to 0.7 pound N (1.5 to two pounds ammonium nitrate) after harvest.
  - Blueberries: Apply 0.02 pound N (0.1 pound ammonium sulfate) per plant per year of age up to a maximum of 0.14 pounds N per plant. Split into two applications - one in February and one in June or after harvest. Ammonium N source are recommended for blueberries. Do not lime for blueberries. Note: For plants not mentioned above use the recommendations for plants with similar growth characteristics.
- 112. Final remark. For small areas, comments give examples of ways to meet the fertilizer recommendations. Other fertilizer grades or materials that supply equivalent amounts of plant nutrients may be used with equal results. If you need assistance in calculating amounts of other materials to use contact your county agent or fertilizer supplier.

Crop Code No. 96

Blueberries

Phosphorus	Potassium				
	Very high	High	Medium	Low	Very low
Pounds N-P <sub>2</sub> O <sub>5</sub> -K <sub>2</sub> O per acre					
Very high .....	*- 0-0	*- 0- 0	*- 0-50	*- 0-50	*- 0-50
High .....	*- 0-0	*- 0- 0	*- 0-50	*- 0-50	*- 0-50
Medium .....	*-50-0	*-50-50	*-50-50	*-50-50	*-50-50
Low .....	*-50-0	*-50-50	*-50-50	*-50-50	*-50-50
Very low .....	*-50-0	*-50-50	*-50-50	*-50-50	*-50-50
K requirement level . . . . .	2		N rate . . . . . *		
Lime code no. . . . .	0		PK code no . . . . . .25		
Mg code no. . . . .	3				

Comment:

- 163. Blueberries - Final remark. Apply P and K as recommended in February.
  - Apply nitrogen as follows: During first two years, apply 0.01 pound N (0.05 pound ammonium sulfate) per plant per year of age in February, April and repeat in June.
  - Beginning in third year, apply 0.01 N (0.05 pound ammonium sulfate) per plant per year of age in February, April and repeat after harvest up to a maximum of 0.07 pound N per application of 0.14 pound N per year.

## RESEARCH

Crop Code No. 98

### CHECKS AND BALANCES

A supply of check soil samples from each soil group on which the test soil values are known is maintained in the laboratory. One of these samples and a blank, which contains no soil, are run through all procedures with each batch of 30 to 45 samples, to be certain that accuracy of analysis is maintained in the laboratory.

Crop Code No. 99

### RESEARCH

This crop code number is used primarily for research samples. The computer prints pounds per acre of soil-test P, K, Ca, and Mg, and soil pH on regular soil-test forms. Lime recommended is to raise soil pH to 6.5. This code can also be used on other samples when this information is desired.

#### Special Comments That May Be Added By The Computer When Needed

146. Type of pasture plants to be grown was unknown. If other than above, please notify the Soil Testing Laboratory and proper recommendations will be given. -

149. Crops to be grown were unknown. If other than above, please notify the Soil Testing Laboratory for proper recommendations.

150. For nematode analysis, contact your local county Extension office for supplies and instructions.

151. Type of lawn grass that you are growing was unknown. If it is other than above, notify the Soil Testing Laboratory for proper recommendations.

152. It was not known if grass species is for a lawn or pasture. Therefore, we have given you both recommendations for this grass and you should follow the appropriate one.

153. If above lawn grasses are mixed, follow the recommendation for the grass you prefer.

154. For additional information, contact your local county Extension office.

157. If cool-season grasses (fescue, orchardgrass, ryegrass, etc.) and clovers are grown in the same pasture with summer grasses (bahia, bermuda, dallis, etc.) follow the recommendation for the crop you prefer.

Comment 221. Both soil acidity and low Mg can be corrected by applying dolomitic lime at the recommended rate.

Comment 222. Low Mg may be corrected by applying 25 pounds per acre of Mg as magnesium sulfate, magnesium oxide, or sulfate of potash-magnesium; or if the pH is 6.5 or below, by applying 1,000 pounds per acre of dolomitic limestone.

Comment 223. Low Mg may be corrected by applying 25 pounds per acre of Mg as magnesium sulfate, magnesium oxide, or sulfate of potash-magnesium. These crops have a high Mg requirement but are sensitive to high pH (Irish potatoes, blueberries, Christmas trees, tobacco).

If crop codes 13 and 17 appear together then comment 250 should appear:

Comment 250. For corn-peanut rotations, apply all the recommended P and K to the corn. No additional P or K should be needed by the peanuts the following year. The recommendation for corn in the rotation is:

If crop codes 13 and 24 appear together then comment 251 should appear:

Comment 251. For corn-soybean rotations, apply all the recommended P and K to the corn. No additional P or K should be needed by the soybeans the following year. The recommendation for corn in the rotation is:

If crop codes 27 and 17 appear together then comment 252 should appear:

Comment 252. For small grain-peanut rotations, apply all the recommended P and K to the small grain. No additional P or K should be needed for peanuts the following year. The recommendation for small grain rotation is:

If crop codes 27 and 24 appear together then comment 253 should appear:

Comment 253. For small grain-soybean rotations, apply all the recommended P and K to the small grain. No additional P or K should be needed for soybeans the following year. The recommendation for small grain in the rotation is:

If lime is recommended and comments 221 and 222 do not appear then comment 254 should appear:

Comment 254. Soil acidity (low pH) can be corrected with either dolomitic or calcitic lime.

If no P or K is recommended on crop codes 1 through 27 then comment 255 should appear:

Comment 255. If no P or K is recommended and none is applied, sample again next year.

## EQUATIONS

1.  $Y = 70 - 2.10X$
2.  $Y = 70 - 1.28X$
3.  $Y = 70 - 0.89X$
4.  $Y = 80 - 2.58X$
5.  $Y = 80 - 1.57X$
6.  $Y = 80 - 1.10X$
7.  $Y = 80 - 0.99X$
8.  $Y = 80 - 0.74X$
9.  $Y = 80 - 0.66X$
10.  $Y = 80 - 0.55X$
11.  $Y = 80 - 0.49X$
12.  $Y = 80 - 0.41X$
13.  $Y = 90 - 2.80X$
14.  $Y = 90 - 1.70X$
15.  $Y = 90 - 1.19X$
16.  $Y = 90 - 1.07X$
17.  $Y = 90 - 0.72X$
18.  $Y = 90 - 0.54X$
19.  $Y = 90 - 0.46X$
20.  $Y = 90 - 0.35X$
21.  $Y = 100 - 3.28X$
22.  $Y = 100 - 2.00X$
23.  $Y = 100 - 1.40X$
24.  $Y = 100 - 1.26X$
25.  $Y = 100 - 0.84X$
26.  $Y = 100 - 0.63X$
27.  $Y = 100 - 0.56X$
28.  $Y = 100 - 0.52X$
29.  $Y = 100 - 0.42X$
30.  $Y = 110 - 3.85X$
31.  $Y = 110 - 2.34X$
32.  $Y = 110 - 2.08X$
33.  $Y = 110 - 1.64X$
34.  $Y = 110 - 1.47X$
35.  $Y = 110 - 1.25X$
36.  $Y = 110 - 0.98X$
37.  $Y = 110 - 0.87X$
38.  $Y = 110 - 0.74X$
39.  $Y = 110 - 0.66X$
40.  $Y = 110 - 0.49X$
41.  $Y = 110 - 0.41X$
42.  $Y = 120 - 3.98X$
43.  $Y = 120 - 2.42X$
44.  $Y = 120 - 2.11X$
45.  $Y = 120 - 1.69X$
46.  $Y = 120 - 1.53X$
47.  $Y = 120 - 1.27X$
48.  $Y = 120 - 1.02X$
49.  $Y = 120 - 0.99X$
50.  $Y = 120 - 0.89X$
51.  $Y = 120 - 0.77X$
52.  $Y = 120 - 0.67X$
53.  $Y = 120 - 0.62X$
54.  $Y = 120 - 0.50X$
55.  $Y = 130 - 4.20X$
56.  $Y = 130 - 2.55X$
57.  $Y = 130 - 1.79X$
58.  $Y = 130 - 1.23X$
59.  $Y = 130 - 1.08X$
60.  $Y = 130 - 0.82X$
61.  $Y = 130 - 0.72X$
62.  $Y = 130 - 0.62X$
63.  $Y = 130 - 0.54X$
64.  $Y = 130 - 0.48X$
65.  $Y = 130 - 0.35X$
66.  $Y = 140 - 2.51X$
67.  $Y = 140 - 1.51X$
68.  $Y = 140 - 1.05X$
69.  $Y = 140 - 0.52X$
70.  $Y = 150 - 2.77X$
71.  $Y = 150 - 1.67X$
72.  $Y = 150 - 1.16X$
73.  $Y = 160 - 4.67X$
74.  $Y = 160 - 2.85X$
75.  $Y = 160 - 1.99X$
76.  $Y = 160 - 1.32X$
77.  $Y = 160 - 1.00X$
78.  $Y = 160 - 0.81X$
79.  $Y = 170 - 5.69X$
80.  $Y = 170 - 3.46X$
81.  $Y = 170 - 2.42X$
82.  $Y = 170 - 1.46X$
83.  $Y = 170 - 1.10X$
84.  $Y = 170 - 0.97X$
85.  $Y = 170 - 0.72X$
86.  $Y = 170 - 0.55X$
87.  $Y = 180 - 6.21X$
88.  $Y = 180 - 5.60X$
89.  $Y = 180 - 3.77X$
90.  $Y = 180 - 3.41X$
91.  $Y = 180 - 3.16X$
92.  $Y = 180 - 2.64X$
93.  $Y = 180 - 2.38X$
94.  $Y = 180 - 1.91X$
95.  $Y = 180 - 1.33X$
96.  $Y = 180 - 0.72X$
97.  $Y = 180 - 0.55X$
98.  $Y = 190 - 3.47X$
99.  $Y = 190 - 2.09X$
100.  $Y = 190 - 1.45X$
101.  $Y = 190 - 1.08X$
102.  $Y = 190 - 0.98X$
103.  $Y = 190 - 0.72X$
104.  $Y = 190 - 0.67X$
105.  $Y = 190 - 0.53X$
106.  $Y = 190 - 0.49X$
107.  $Y = 200 - 2.64X$
108.  $Y = 200 - 1.59X$
109.  $Y = 200 - 1.11X$
110.  $Y = 200 - 0.52X$
111.  $Y = 210 - 5.36X$
112.  $Y = 210 - 3.25X$
113.  $Y = 210 - 2.27X$
114.  $Y = 210 - 1.37X$
115.  $Y = 210 - 0.91X$
116.  $Y = 210 - 0.88X$
117.  $Y = 210 - 0.67X$
118.  $Y = 210 - 0.59X$
119.  $Y = 210 - 0.43X$
120.  $Y = 220 - 2.68X$
121.  $Y = 220 - 1.79X$
122.  $Y = 220 - 1.35X$
123.  $Y = 220 - 1.11X$
124.  $Y = 220 - 0.68X$
125.  $Y = 220 - 0.44X$
126.  $Y = 230 - 1.11X$
127.  $Y = 300 - 2.55X$
128.  $Y = 300 - 1.71X$
129.  $Y = 300 - 1.29X$
130.  $Y = 320 - 1.27X$
131.  $Y = 320 - 1.79X$
132.  $Y = 320 - 1.20X$
133.  $Y = 320 - 0.90X$
134.  $Y = 330 - 0.87X$
135.  $Y = 460 - 2.95X$
136.  $Y = 460 - 1.97X$
137.  $Y = 460 - 1.48X$
138.  $Y = 480 - 1.49X$



