APPENDIX B

SOIL TEST NOTES
(Supplement to Soil Test Report)

No	MA	Title
1	231	Explanation of laboratory tests.
2	232	Field crops.
3	233	Forage crops.
4	234	Trace element application.
5	235	Use of manures.
6	236	Flue-cured tobacco.
7	237	Dark-fired tobacco.
8	238	Sun-cured tobacco.
9	239	Burley tobacco.
10	240	Commercial apple production.
11	241	Commercial peach production.
12	242	Commercial forest tree crops.
13	243	Commercial greenhouse & nursery production.
14	244	Fairways, large industrial lawns, athletic fields, and sod production.
15	245	Putting greens.
16	246	Golf tees.
17	247	Maintaining Kentucky bluegrass & fescue lawns.
18	248	Maintaining bermudagrass and zoysiagrass lawns.
19	249	Vegetable gardens, flower gardens, roses, potted house plants.
20	250	Home shrubs & trees.
21	251	Home fruit trees.
22	252	Small fruits for home use.

VIRGINIA POLYTECHNIC INSTITUTE & STATE UNIVERSITY
EXTENSION DIVISION SOIL TESTING LABORATORY
MA-231 April, 1979

SOIL TEST NOTES
(Supplement to Soil Test Report)

NOTE 1. Explanation of Laboratory Tests

The VPI&SU Soil Testing Laboratory offers two types of tests, a routine test, which is performed on all samples, and 5 special tests, which are offered individually on a request basis. The routine test is used for making the basic lime and fertilizer (nitrogen, phosphate, potash) recommendations while the special tests are offered for certain situations where a need for the individual test has been determined. The following is an explanation of the soil tests offered by the laboratory.

ROUTINE TEST (Soil pH, Buffer Index, P, K, Ca, Mg)

Soil pH. Soil pH or acidity is important because it affects the availability of most of the essential plant nutrients and the activity of soil microorganisms. A pH of 7 is considered neutral, less than 7 is acid, and greater than 7 is alkaline. In general, a pH of 6.5 is considered optimum for most crops grown on mineral soils except alfalfa, tobacco, and certain other crops. Soil pH greater than 7 may result in trace element deficiencies while a pH less than 5.2 may cause problems of aluminum and/or manganese toxicity and phosphorus and/or magnesium deficiency. For organic soils, the optimum pH is 5.0 to 5.2 for most crops because of the low aluminum content and buffering capacity of these soils.

Phosphorus (P). Phosphorus is one of the three major elements (N, P, K) required by crops in relatively large amounts for optimum growth. For most crops and most soils, crop response to phosphate (P_2O_5) fertilizer will nearly always be

observed for soils testing Low(L), frequently for soils testing Medium (M), and usually will not be observed for soils testing High(H). High is the desired level which should be the objective of most soil building programs. A small amount of fertilizer is usually recommended at High to maintain this level.

Potassium (K). Potassium is another one of the three major elements (N, P, K) required by crops in relatively large amounts for optimum growth. For most crops and most soils, crop response to potash (K2O) fertilizer will nearly always be observed for soils testing Low(L), frequently for soils testing Medium(M), and usually will not be observed for soils testing High(H). High is the desired level for most soils. One exception is the sandy Coastal Plain soils where a combination of low nutrient-holding capacity in the topsoil and accumulation of potassium in the subsoil sometimes produces little crop response to K2O fertilizer although the soil may only be testing in the Medium range. For these soils, a Medium-to-High K test should be the goal for top production.

Calcium (Ca). Calcium is a secondary element normally supplied to the plant in the form of limestone. The calcium level is rarely low enough to cause deficiencies in crops other than peanuts and some vegetables. In most situations where the Ca test is low, the soil pH is also low and the lime application recommended to correct the pH will add ample amounts of calcium to the soil. Regarding peanuts, gypsum or landplaster (CaSO4) is recommended to prevent a deficiency of this element.

Magnesium (Mg). Magnesium is another secondary element that is normally supplied to the plant in the form of limestone. Deficiencies of this element may occur when the Mg test level is Low or Low-. At these levels, the soil pH is also usually low and dolomitic limestone, which contains ample amounts of magnesium, is normally recommended. In situations where the soil pH is

optimum and no lime is needed but Mg tests Low or Low-, a separate magnesium fertilizer is recommended.

SPECIAL TESTS (OM, SS NO3-N, Zn, Mn)

Organic Matter (OM). The Organic Matter test gives an indirect indication of the tilth of the soil. In general, the greater the organic matter level, the better the soil's tilth. Unfortunately, the relatively warm and humid climate of Virginia allows little organic matter to accumulate. The average organic matter level of most Virginia soils is less than 2%. The principle use of the organic matter test is to determine the proper amount of herbicide to use in crop production. Organic matter tends to tie up or complex some herbicides, and these herbicides need to be applied at a higher rate on soils with high organic matter levels (actual amounts to apply are normally specified on the herbicide label). Because most soils change very little in organic matter content over time after they are brought into production, this test needs to be run only once every 5 years or so.

Soluble Salts (SS). This test is used primarily to determine if too much fertilizer has been applied to the crop or placed too close to the seed causing a toxic salt effect. It is used primarily by greenhouse operators who work with confined soil systems (benches, pots) where the possibility of salt buildup is very real. This test is not normally run on field soils where soluble salt levels in normal crop production are almost always low, unless one is attempting to determine the cause of poor crop growth and suspects that fertilizer has been placed too close to the seed. Since crops vary in their tolerance to soluble salts, the plant species must be taken into consideration in interpreting the soluble salt level.

Nitrate-Nitrogen (NO3-N). This test is used primarily by greenhouse operators who work with confined soil systems and fertilize on a frequent

basis. In this specialized management system where the soil fertility level is closely monitored, the NO3-N test is used to indicate both when to fertilize and how much to apply. The NO3-N test is generally not applicable for field soils in Virginia because the relatively high rainfall in this region leaches much of the nitrate out of the soil resulting in very low (less than 5 parts per million) or variable soil nitrate levels most of the time. Nitrogen recommendations are based on research where different rates of nitrogen were applied to crops grown on different Virginia soils over a number of years.

Zinc (Zn). Deficiency of this trace element usually occurs under conditions of high soil pH and Very High phosphorus soil test levels, but has been found to occur only on corn, small grains, and grain sorghum in Virginia. For these crops, a soil test zinc level of 0.8 ppm or less is considered deficient. Other crops would not normally be expected to respond to zinc even when the soil test indicates a low level because of their ability to utilize lower levels of zinc more efficiently and/or because of differences in their nutritional needs.

Manganese (Mn). Deficiency of this trace element occurs primarily on the sandy Coastal Plain soils in eastern Virginia under conditions of high soil pH. Manganese deficiency has been identified only on soybeans and peanuts in Virginia. The critical soil test level for these crops varies depending on the soil pH. Other crops would not normally be expected to respond to manganese even when the soil test indicated a low level because of their ability to utilize lower levels of manganese more efficiently and/or because of differences in their nutritional needs.

OTHER ESSENTIAL ELEMENTS

Extensive research has been and continues to be conducted for those essential plant elements for which soil tests are not presently offered. It is

the philosophy of the VPI&SU Soil Testing Program to offer a soil test if 1) deficiencies have been observed on crops in Virginia and 2) if suitable soil test methods have been developed under Virginia conditions to reliably predict crop response to a given nutrient. In instances where deficiencies, or soil test methods compatible with Virginia soils, have not been found, the soil testing program will not offer tests for these elements. The tests presently offered by the laboratory (and the general recommendations made for certain trace elements in cases where good soil test methods have not been found) are based on the most current findings in soil-plant relationships and crop nutrient needs in Virginia.

ADDITIONAL INFORMATION

Additional information may be obtained from your local VPI&SU Cooperative Extension Office. Publications available at present are:

MA-143. Laboratory Procedures. VPI&SU Soil Testing Laboratory.

Prepared by: S.J. Donohue, Extension Specialist, Soil and Plant Analysis

VIRGINIA POLYTECHNIC INSTITUTE & STATE UNIVERSITY
EXTENSION DIVISION SOIL TESTING LABORATORY
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SOIL TEST NOTES
(Supplement to Soil Test Report)

NOTE 2. Field Crops

LIME

In general, the best method of lime application is one which will mix the lime most completely with the soil to the plow depth. The following are guidelines for lime application under conventional tillage:

Applications of 2 tons or less per acre - adding this in a single application either before or after plowing will usually give good results. Lime applied before plowing should be disked into the soil and then plowed. Lime applied after plowing should be disked into the soil as thoroughly as possible.

Application of more than 2 tons per acre - for best results, apply one-half of the lime, disk into the soil, plow under and then apply the second-half and disk into the soil. This method offers the best incorporation of lime into the soil and is particularly important when the soil pH is very low and large amounts of lime are needed.

For no-till cropping systems where incorporation of lime is not possible, single applications should be limited to no more than 2 tons per acre. Where more than 2 tons per acre are recommended (indicating very low soil pH), lime should be incorporated as mentioned above for best results. If incorporation is not feasible, apply one-half the total amount one year and the other half the next year.

Time of Application - the best time to apply lime is several months ahead of planting. This allows for more complete reaction of the lime with the soil. However, if this cannot be done, apply it as early as possible, before the crop is planted. Failing to apply lime because it could not be applied at the best time is worse than applying it late.

NITROGEN

Corn, Grain Sorghum - nitrogen (N) fertilizer is commonly applied in solution form at planting along with the herbicide. On sandy soils with greater potential for nitrogen leaching loss, a split-application is often used, with part of the nitrogen being applied at planting and the remainder applied when the corn is 12" high. Another method of application is to apply nitrogen with the phosphate and potash in the spring before planting. However, since many farmers either apply the phosphate and potash in the fall or use an herbicide solution at planting in the spring, less nitrogen is applied in this manner. Fall application of nitrogen for spring-planted crops is not recommended because of the potential for leaching loss over the winter. One exception to this would be where a nitrification inhibitor is used which would reduce this leaching loss.

Small Grains - for Coastal Plain and Southern Piedmont Regions, one-fourth of the recommended nitrogen should be applied in the fall, and the remaining three-fourths should be applied in late winter or early spring. For Northern Piedmont and Appalachian Regions, one can use either a split application or apply all of the nitrogen in the fall.

PHOSPHATE, POTASH

The recommended phosphate (P_2O_5) and potash (K_2O) fertilizer should be broadcast and incorporated into the soil, where possible, by plowing or disking. Application can be made either in the fall or spring before planting, since both

nutrients move very slowly in the soil and are not subject to leaching loss.

For small grain-soybean or small grain-grain sorghum double cropping rotations, phosphate and/or potash fertilizer needed for both crops should be applied ahead of the small grain crop to permit incorporation of the fertilizer into the soil. For corn-peanut rotations, the phosphate and potash should be applied and incorporated ahead of the corn crop, primarily to avoid high concentrations of potash in the pegging zone for the peanuts.

STARTER FERTILIZER

Starter fertilizer is fertilizer placed in a band alongside the seed or placed in direct contact with the seed. Starter fertilizer can be beneficial in situations where one is planting in cold and/or wet soils or where the P and/or K soil test is High to Very High.

In cold and/or wet soils (often found when planting early), root growth is slower and plants may not have ready access to all the fertilizer they require for optimum growth. Use of a starter fertilizer here to concentrate the plant nutrients near the seed would be beneficial. In soils testing High to Very High in P and/or K, response to broadcast application of fertilizer is not normally found, while starter fertilizer will almost always give an early growth response and will often give a few extra bushels per acre in yield.

In deciding whether to use starter fertilizer, equipment needs must be considered. Where existing planting equipment is in good operating condition, one probably could not justify switching to new equipment with fertilizer attachments for the extra yield to be realized. However, if planting equipment is to be replaced, then planters with fertilizer attachments should be considered.

Rates for starter fertilizer application are 30 to 60 pounds of nitrogen plus (+) potash per acre for band placement, or 10 to 15 pounds of nitrogen plus (+) potash per acre for seed contact placement (e.g., 50 lbs/A of 6-24-24).

TRACE ELEMENT NEEDS

Trace element deficiencies have been found on the following field crops in Virginia: Zinc--corn, small grains, grain sorghum; Manganese--soybeans and peanuts; Boron--peanuts and cotton; Molybdenum--soybeans. Soil tests are offered for zinc and manganese but, for boron and molybdenum, the soil test has not been found to be a reliable predictor of crop response (e.g., in 16 boron experiments on corn conducted throughout Virginia over a 10 year period, boron fertilizer did not increase yields even though the boron soil test in all locations was Low, according to standards being used by some soil testing labs, indicating that the boron test is a poor predictor of crop response). In situations where trace element deficiencies have been found but no reliable soil tests are available, a general recommendation is made for the trace element in question.

WINTER ANNUAL LEGUMES AS A NITROGEN SOURCE

Winter annual legumes, in addition to their merits as a cover crop, can also be used to supplement fertilizer nitrogen in the crop rotation. Since they are legumes, they have the ability to fix or utilize nitrogen from the soil atmosphere to supply their nitrogen needs. When they decompose, they release this nitrogen into the soil which then becomes available to the next crop in the rotation.

Three winter annual legumes which show potential in Virginia are crimson clover, Austrian winter peas, and hairy vetch. When seeded in August to early September for a good winter stand, these legumes will provide about 80 pounds of nitrogen per acre to the following spring-planted crop. If planted late (i.e., October), 40 to 50 pounds of

nitrogen will be available to the following crop because less growth will be produced by the legume.

Several precautions should be taken when growing these legumes as a nitrogen source. Crimson clover should be planted early (August) since the later it is seeded, the more readily it winterkills. Even with early establishment, severe winters may cause stand reduction. Crimson clover also should not be planted on poorly drained soils since it does not thrive on these soils. Use of hairy vetch is limited due to hard seed that will volunteer in subsequent small grain crops. In counties west of the Blue Ridge mountains where few small grains are grown, hairy vetch use as a cover crop can be considered. Finally, winter annual legumes should not be used in rotations with peanuts (where this crop is grown) due to buildup and spread of diseases which attack peanuts.

ADDITIONAL INFORMATION

Additional information may be obtained from your local VPI&SU Cooperative Extension Office.

Prepared by:
S.J. Donohue, Extension Specialist, Soil and Plant Analysis
G.W. Hawkins, Extension Specialist, Soil Fertility
G.D. McCart, Extension Specialist, Soil Fertility

VIRGINIA POLYTECHNIC INSTITUTE & STATE UNIVERSITY
EXTENSION DIVISION SOIL TESTING LABORATORY
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SOIL TEST NOTES
(Supplement to Soil Test Report)

NOTE 3. Forage Crops

LIME

Establishment of New Seedings. The following are guidelines for lime application where incorporation into the soil is possible:

Less than 2 tons per acre recommended - a single application of lime made either before or after plowing will usually give good results. Lime applied before plowing should be disked into the soil and then plowed. Lime applied after plowing should be disked into the soil as thoroughly as possible.

More than 2 tons per acre recommended - for best results, apply one-half of the lime, disk into the soil, plow under and then apply the second half and disk into the soil. This method offers the best incorporation of lime into the soil and is important when the soil pH is very low and large amounts of lime are needed.

Maintenance of Pastures, Hayfields. Normally, surface application of up to 2 to 3 tons of lime per acre will effectively reduce acidity in the upper 2 to 4" of soil. However, where more than 3 tons/A of lime is required, additional lime above the 3 ton rate applied to the surface will have little beneficial effect on crop growth. If the existing pasture or hayfield is in poor condition and not yielding well, it would be worthwhile, where possible, to consider plowing-up the old sod and reseeding, at which time the lime can be incorporated.

NITROGEN, PHOSPHATE, POTASH

Nitrogen fertilizer promotes grass growth and can produce significant yield increases when used on pastures or hayfields that are predominantly grass. However, by encouraging grass growth, legumes tend to be forced out of the stand due to the over-competition of the grass. For this reason, grass-legume pastures and hayfields where legumes make up an appreciable percent of the stand should not be fertilized with nitrogen.

Nitrogen leaches easily from the soil which is one reason split-applications are normally recommended. In contrast, phosphate and potash move rather slowly in the soil. Where possible, these two nutrients should be incorporated into the soil by plowing or disking for best results (e.g., at seeding). After establishment of the crop, only surface application is possible which is not as advantageous as deeper incorporation into the soil.

TRACE ELEMENT NEEDS

Trace element deficiencies have been found on the following forage crops in Virginia: Boron--alfalfa; Molybdenum--alfalfa. Soil tests for boron and molybdenum have not been found to be reliable predictors of crop response. For these elements, a general recommendation is made in situations where deficiencies would be likely.

ASCS RECOMMENDATIONS

Lime and fertilizer recommendations for the ASCS program are designed to provide for soil and/or watershed protection. Additional nitrogen fertilizer above what is recommended for increased forage production during the period of this program is not covered by the Federal cost-sharing program. Also, if the pasture is being intensively managed for top production, more phosphate and/or potash will be required after 2 years. The specific amount of phosphate and/or potash needed at that time should be determined by

submitting another soil sample to the soil testing laboratory.

ADDITIONAL INFORMATION

Additional information may be obtained from your local VPI&SU Cooperative Extension Office.

Prepared by:
S.J. Donohue, Extension Specialist, Soil and Plant Analysis
H.E. White, Extension Specialist, Forages
G.W. Hawkins, Extension Specialist, Soil Fertility

VIRGINIA POLYTECHNIC INSTITUTE & STATE UNIVERSITY
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SOIL TEST NOTES
(Supplement to Soil Test Report)

NOTE 4. Trace Element Application

INTRODUCTION

Your Soil Test Report contains information on the basic amounts of lime, major (N, P2O5, K2O), and secondary (Ca, Mg) elements required for optimum growth, and also indicates whether one or more trace elements are needed. For those trace elements recommended, select the appropriate sections in this note for information on specific rates and methods of application. Apply only those trace elements which were recommended, and only at the recommended rates!

ZINC (Zn)

Zinc deficiency has been found on corn, small grains, and grain sorghum in Virginia. If your Soil Test Report indicates a need for zinc, select from one of the following application methods:

1. Broadcast and disked-in or plowed-down.
   a. Coastal Plain soils - apply 10 to 12 pounds of elemental zinc per acre when using zinc sulfate or zinc oxide as the source, or 2 to 3 pounds of elemental zinc per acre when using the zinc chelates, such as zinc EDTA, as the source.
   b. Piedmont, Appalachian Region soils - apply 20 to 25 pounds of elemental zinc per acre when using zinc sulfate or zinc oxide as the source. Zinc chelates are not economical sources when zinc is broadcast on Piedmont or Appalachian Region soils.
   c. Research to date indicates broadcast

applications of the above rates will correct deficiencies for a period of 3 to 5 years. The most feasible way of broadcasting the zinc would be to have it mixed with a fertilizer that is to be spread.

2. Seed contact placement. Zinc can be applied in contact with the seed at planting time as part of a fertilizer application being made with a grain drill or with fertilizer attachments on the planters. Care should be used in the rate of application of the pop-up fertilizer for corn and grain sorghum to avoid germination injury. If this method of application is used, apply 1/2 pound of elemental zinc per acre using the zinc chelates as the source, or 1 pound per acre using zinc sulfate as the source. This method of application will not correct the deficiency in succeeding crops and would need to be applied each year these crops are planted.

3. Sideband placement for corn and grain sorghum. Zinc can be applied with the starter fertilizer at planting time. Where this method is used, apply 6 to 8 pounds of elemental zinc per acre using either zinc sulfate or zinc oxide as the source, or 1 to 2 pounds per acre when the zinc chelates are used as the source. This method of application will not correct the deficiency for succeeding crops, but would need to be applied each year these crops are grown.

4. Foliar application. Zinc can be supplied to crops through zinc-containing sprays applied directly to the leaves and stalks. If this method is used, apply 1/2 pound of elemental zinc per acre per application using the zinc chelates as the source, or 1 pound per acre per application using zinc sulfate or zinc oxide (micronized) as the source. Usually, the best time of application for corn and grain sorghum is when plants are 6 to 8 inches high. Use enough water to wet the plants.

MANGANESE (Mn)

Manganese deficiency has been found on soybeans and peanuts grown in Virginia. If your Soil Test Report indicates a need for manganese, select from one of the following application methods:

1. Foliar application. Apply 3/4 to 1 pound of elemental manganese per acre in enough water to wet the entire plant. Manganese sulfate, manganese oxide (micronized), and manganese chelates may be used as sources of manganese. If the chelates are used, use the 3/4 pound rate. Repeat the application if deficiency symptoms reappear (i.e., from 1 to 3 applications). Make all applications before August 15.

   Manganese can be applied with pesticides if the manganese source and the pesticide are compatible, if applying them as a mixture does not violate label restrictions on the pesticide, and if it does not violate state or federal regulations.

2. Sideband placement. If a starter fertilizer is to be applied at the time the crop is being planted, manganese can be added with the fertilizer. If this method is used, apply 8 to 10 pounds of elemental manganese per acre using manganese sulfate, manganese oxide, or manganese chelates as the source. Starter fertilizers should be placed 2 inches to one side and 2 inches below seed level tc avoid salt injury to the germinating seed.

3. Seed contact placement. (Important--for peanuts only! This method of application may damage soybeans!) Manganese can be applied in contact with the peanut seed at planting time with fertilizer attachments on the planters. Care should be used in the rate of application to avoid germination injury. If this method of application is used, apply 3 to 5 pounds of elemental manganese per acre using an available granular manganese fertilizer

source. This method of application will only correct the deficiency in the immediate crop and would need to be applied each year the peanuts are planted.

4. Broadcast application. Broadcast application is not practical in a system of indirect fertilization. If manganese is to be broadcast, it should be applied within two to three weeks of the time the crop will be planted because of the short residual effect of broadcast applications. Apply 25 to 30 pounds of elemental manganese using manganese sulfate or manganese oxide as the source.

BORON (B)

Boron deficiency has been found on alfalfa, apples, cotton, peanuts, and on several commercial vegetable crops grown in Virginia. The following are suggested rates and methods of boron application (for boron fertilization of apples, refer to Soil Test Note 10):

1. Alfalfa. Apply 2 to 4 pounds of elemental boron per acre per year with a broadcast fertilizer.

2. Asparagus. Apply 2 pounds of elemental boron per acre every 3 years with a broadcast fertilizer.

3. Broccoli, Cauliflower, Cabbage. Apply 2 to 3 pounds of elemental boron per acre with a broadcast fertilizer.

4. Brussels Sprouts, Collards, Muskmelons, Tomatoes, Onions, Peas, Peppers, White Potatoes. Apply 1 to 2 pounds of elemental boron per acre with a broadcast fertilizer.

5. Cotton. Apply 1/2 pound of elemental boron per acre per year in a compatible labeled pesticide spray or dust or as a separate foliar application.

6. Peanuts. Apply 1/2 pound of elemental boron per acre per year at early bloom stage in a compatible labeled pesticide spray or dust or as a separate foliar application. Information on specific boron sprays and dusts are found in the Peanut Production Guide for Virginia (VPI&SU MA-197).

MOLYBDENUM (Mo)

Molybdenum deficiency has been found on alfalfa, soybeans, and on certain commercial vegetable crops grown in Virginia. If your Soil Test Report indicates a need for molybdenum, the following are suggested rates and methods of application for the particular crop to be grown:

1. Alfalfa. Molybdenum may be applied as a foliar spray at the rate of 1/2 pound of elemental molybdenum per acre or as a seed treatment at the rate of 1 ounce of elemental molybdenum per acre. Important - molybdenum is toxic to livestock! Do not graze forage if molybdenum is sprayed on foliage until after a soaking rain.

2. Broccoli, Cauliflower. Apply 1/4 pound of elemental molybdenum per acre with a broadcast fertilizer.

3. Soybeans. Molybdenum may be applied as a foliar spray at the rate of 1/2 pound of elemental molybdenum per acre or as a seed treatment at the rate of 1 ounce of elemental molybdenum per acre.

ADDITIONAL INFORMATION

Additional information may be obtained from your local VPI&SU Cooperative Extension Office.

Prepared by:
S.J. Donohue, Extension Specialist, Soil and Plant Analysis
G.W. Hawkins, Extension Specialist, Soil Fertility
A.H. Allison, Extension Specialist, Peanuts

VIRGINIA POLYTECHNIC INSTITUTE & STATE UNIVERSITY
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SOIL TEST NOTES
(Supplement to Soil Test Report)

NOTE 5. Use of Manures

INTRODUCTION

Manure is a valuable source of plant nutrients. Manure also improves soil tilth, increases rate of infiltration of rainfall into soil, increases moisture holding capacity, and enhances the growth of soil organisms. Tables 1, 2, and 3 show the amount, based on handling system and source, of nutrients which can be obtained from manure the first year following application. These are average values and may vary depending on the type of storage and method of incorporation used. Table 4 contains information on nitrogen (N) losses from land application of manure and is useful in determining how much N will be available to the crop from a given application. The following sections contain information on adjustment of fertilizer recommendations where manure is being used in the cropping system, as well as amounts of manure that are commonly applied.

ADJUSTING FERTILIZER RECOMMENDATIONS FOR USE OF MANURES

Because manures vary in their nutrient concentration, and because significant losses of N from manure occur when the manure is not incorporated into the soil shortly after spreading, it is necessary to follow the following four steps to properly adjust your fertilizer recommendations.

1. Select Manure Nutrient Value. In Table 1, 2, or 3, find the specific amounts of plant-

available N, P2O5, and K2O in the type of manure you have available. Example: For dairy cattle manure (solid), there are 4 lbs of N, 3 lbs of P2O5, and 8 lbs of K2O per ton of manure.

2. Adjust Manure N Value. In Table 4, locate the appropriate Manure N Multiplication Factor and multiply the N content of the manure by this value to adjust for volatilization losses. Example: For dairy cattle manure (solid) incorporated one day after spreading, 4 lbs of N/ton x 0.8 (N Factor) = 3.2 lbs of plant available N/ton of manure.

3. Determine Total Nutrients From Manure To Be Applied Per Acre. Multiply the adjusted nutrient content of the manure by the amount you will be applying per acre for the total amount of nutrients you will be obtaining from the manure. Example: For dairy cattle manure (solid) to be applied at the rate of 10 tons per acre and incorporated one day after spreading, 3.2 lbs N/ton (4 lbs x 0.8 N Factor) x 10 tons/A = 32 lbs N/A; 3 lbs P2O5/ton x 10 tons/A = 30 lbs P2O5/A; and 8 lbs K2O/ton x 10 tons/A = 80 lbs K2O/A.

4. Adjust Fertilizer Recommendations. Subtract the total nutrients in the manure to be applied per acre (Step 3) from the basic recommendations on your Soil Test Report. This fertilizer adjustment for manure does not apply to row or starter fertilizer, but only to broadcast applications. To determine residual effects of manure in subsequent years, have your soil tested.

RATE OF MANURE APPLICATION

Ten tons of manure per acre is commonly applied for corn, though farmers often apply as much as 15 tons per acre. Five tons of cattle manure, or equivalent of other manures, is suggested for small grains grown in soils low in N, provided there is little danger of lodging. Manures are

also used on pastures, especially those that are predominantly grass, where the N from the manure can be effectively used.

Table 1. General Barnyard Manure--Nutrients Available to Plants in First Year Follcwing Application.

	N	P2O5	K2O
lb/ton of manure	4	5	8

Table 2. Specific Manures From Solid Handling Systems--Nutrients Available to Plants in First Year Following Application.

Species*	Dry Matter	N	P2O5	K2O
	%	lb/ton of manure		
Dairy cattle	20	4	3	8
Swine	18	5	6	6
Sheep	28	2	8	21
Horse	46	4	3	11
Beef cattle				
concrete lot	15	3	5	8
dirt lot	51	7	12	20
Turkey+				
without litter	22	17	15	14
with litter	29	13	12	10
Poultry+				
without litter	45	26	36	27
with litter	75	36	34	27
deep pit	76	44	48	36

* Unless specified, there is little difference in nutrient content between straight manure and manure plus bedding.

+ Because of the relatively high nutrient content and variability of turkey and poultry manures, the manure should be analyzed by a private laboratory for N, P2O5, and K2O content.

Table 3. Specific Manures From Liquid Handling Systems--Nutrients Available to Plants in First Year Following Application.

Species	Dry Matter %	N	P_2O_5	K_2O
		lb/1000 gal. of manure		
Swine				
liquid storage	4	20	20	15
oxidation ditch	3	12	20	15
lagoon	1	3	2	3
Beef cattle				
liquid storage	11	24	20	27
oxidation ditch	3	16	14	23
lagoon	1	2	7	4
Dairy cattle				
liquid storage	8	12	14	23
lagoon	1	2	3	4
Poultry				
liquid storage	13	64	27	77

Table 4. Nitrogen Losses From Manure Between Time of Application and Incorporation into Soil.

Days Between Spreading and Plowing or Disking	Loss of N %	Manure N Multiplication Factor (see text)
0 - 1/2	0	1.0
1/2 - 1	20	0.8
1 - 2	30	0.7
2 - 3	40	0.6
3 - 4	50	0.5

ADDITIONAL INFORMATION

Additional information may be obtained from your local VPI&SU Cooperative Extension Office. Publications available at present are:

Publication 600. A Handbook of Agronomy.

Prepared by:
S.J. Donohue, Extension Specialist, Soil and Plant Analysis
G.D. McCart, Extension Specialist, Soil Fertility

VIRGINIA POLYTECHNIC INSTITUTE & STATE UNIVERSITY
EXTENSION DIVISION SOIL TESTING LABORATORY
MA-236 April, 1979

SOIL TEST NOTES
(Supplement to Soil Test Report)

NOTE 6. Flue-Cured Tobacco

FERTILIZER RECOMMENDATIONS

Your Soil Test Report contains information on the basic amounts of nitrogen, phosphorus, and potassium required for optimum growth of flue-cured tobacco according to the information you provided on the Soil Sample Information Sheet and the results of the laboratory tests. In making the recommendations, average soil and weather conditions and the use of high-level management practices are assumed.

An example of the grade or grades of fertilizer that will fit the nutrients recommended is contained on the report. Other grades or combinations of grades that are available locally may be used if desired in meeting the crop's nutrient needs.

It should be noted that your past experience should be a major consideration in arriving at the final fertilizer rates to use.

Do not apply excessive amounts of fertilizer indiscriminately. There has been a tendency for tobacco growers to use much higher rates of nitrogen, phosphorus, and potassium than can be expected to give profitable returns.

ADJUSTMENT IN NITROGEN RECOMMENDATIONS ACCORDING TO SOIL TYPE AND DEPTH TO SUBSOIL

For sandy loam soils of average fertility, the following table shows the amount of nitrogen needed when leaching losses are low.

Depth to Subsoil, Inches	Nitrogen Suggested, Pounds/Acre
0 - 12	50 - 60
12 - 18	60 - 70
18 - 24	70 - 80

On heavy textured and/or very fertile soils, 40 to 50 lbs of nitrogen will generally be enough. On sandy soils with more than 24 inches to the subsoil, more nitrogem may be needed.

At least 50% of the total nitrogen in the preplant fertilizer should be in the nitrate form. In the sidedressing fertilizer, at least 50% of the nitrogen should be in the nitrate form, and, in many cases, a favorable response can be expected from 100% nitrate-nitrogen. Evidence from numerous experiments has not shown any superiority of natural or synthetic organics over standard inorganic sources of nitrogen for the production of flue-cured tobacco.

ADJUSTMENT IN NITROGEN AND POTASSIUM RECOMMENDATIONS TO COMPENSATE FOR LEACHING

Supplemental nitrogen and potassium, applied in addition to the base amounts recommended, will replace nutrients lost by leaching. Both yield and quality can be greatly reduced if leaching occurs during the early growth period--prior to the time tobacco grows waist high.

On good, sandy loam soils with top soil of 8 to 12", little or no leaching will result frcm a 1" rainfall. The soil will be saturated for a depth of about 12". On coarser textured soil, mcisture-holdimg capacity will be less and leaching will be

greater. On finer textured soil, moisture-holding capacity will be greater and leaching will be less. The use of a rain gauge is strongly recommended so that actual rainfall can be used as a guide in estimating the amount of leaching and the amount of replacement fertilizer to apply. When 2 to 4" of rain falls within a 3- to 5- day period from the time fertilizer is applied to the time tobacco is waist high, it will often be desirable to apply from 15 to 30% of the original quantities of nitrogen and potash to replace these nutrients that have been leached below the effective root zone or carried away in runoff water. The soil type is an important factor in determining the amount of additional nutrients to supply. On deep sandy loam or coarse sandy loam soils, it may be necessary to apply more than 30% of the original nitrogen application. Much lower rates of supplemental materials should be used when tobacco is waist high through bloom stage.

Applications of nitrogen and potash materials to replace elements lost through leaching should be made as soon as possible after heavy rains. Waiting until deficiency symptoms develop before applying supplemental fertilizer is not recommended.

HIGH ANALYSIS FERTILIZERS

The analysis of a fertilizer gives the percent of the different nutrients in the material or mixture. Two fertilizer grade ratios have been available for use on tobacco in Virginia--1:3:3 (3-9-9) and 1:2:3 (4-8-12, 5-10-15, 6-12-18, and 8-16-24). When used at comparable rates, the 1:3:3 ratio will supply more phosphorus, but, since this extra phosphorus usually is not needed, there is seldom justification for using it over the 1:2:3 ratio mixtures.

The cost per unit of nutrient in a high-analysis fertilizer is generally less than in lower-analysis grades. It is also less expensive for growers to handle the higher-analysis grades since they are used at lower rates.

FERTILIZER APPLICATION

In many instances, direct contact of the roots of newly set plants with fertilizer results either in the death of plants or a retardation in early growth. The placement of fertilizer in 2 bands 8-10" apart and slightly deeper than the root crowns, and transplanting between these bands, will help reduce fertilizer injury. Since it is difficult to set the transplants between the bands when the fertilization and transplanting operations are done separately, a combination fertilizer distributor-transplanter is recommended. If band placement equipment is not available, place the fertilizer so that it will be 3-5" below the root crown.

LIME RECOMMENDATIONS

Your Soil Test Report contains information on the amount of lime needed to adjust the pH of the soil to 5.5 - 6.0 for optimum tobacco production. Lime application according to soil test will lower the soil acidity and reduce exchangeable aluminum and manganese, both of which can be toxic to plants. It will also increase the absorption of phosphorus and other nutrients and increase the supply of calcium and magnesium available to the plant.

Lime is never suggested for tobacco except when a soil test indicates there is a need. Tobacco fields should not be overlimed because of the possibility of increasing certain disease problems (black root rot and black shank) and causing an imbalance of certain micronutrients.

FERTILIZING TOBACCO PLANT BEDS

Apply 50-75 lbs of 12-6-6 fertilizer per 100 sq yd and disk into the top 2 to 3" of soil. For further information on tobacco plant beds, refer to the publications listed below.

ADDITIONAL INFORMATION

Additional information may be obtained from your local VPI&SU Cooperative Extension Office. Publications available at present are:

SP-10. 1977 Flue-cured Tobacco Production Guide for Virginia.

Prepared by:
J.L. Jones, Extension Specialist, Tobacco
S.J. Donohue, Extension Specialist, Soil and Plant Analysis

VIRGINIA POLYTECHNIC INSTITUTE & STATE UNIVERSITY
EXTENSION DIVISION SOIL TESTING LABORATORY
MA-237 April, 1979

SOIL TEST NOTES
(Supplement to Soil Test Report)

NOTE 7. Dark-Fired Tobacco

FERTILIZER RECOMMENDATIONS

Your Soil Test Report contains information on the basic amounts of nitrogen, phosphorus, and potassium required for optimum growth of dark-fired tobacco according to the information you provided on the Soil Sample Information Sheet and the results of the laboratory tests. In making the recommendations, average soil and weather conditions and the use of high-level management practices are assumed.

An example of the grade or grades of fertilizer that will fit the nutrients recommended is contained on the report. Other grades or combinations of grades that are available locally may be used if desired in meeting the crop's nutrient needs.

It should be noted that your past experience should be a major consideration in arriving at the final fertilizer rates to use. If manure is to be applied, you will want to refer to Soil Test Note 5 to determine the necessary adjustment in your fertilizer recommendation.

Do not apply excessive amounts of fertilizer indiscriminately. There has been a tendency for tobacco growers to use much higher rates of nitrogen, phosphorus, and potassium than can be expected to give profitable returns.

HIGH ANALYSIS FERTILIZERS

The analysis of a fertilizer gives the percent of the different nutrients in the material or mixture. Two fertilizer grade ratios have been available for use on tobacco in Virginia--1:3:3 (3-9-9) and 1:2:3 (4-8-12, 5-10-15, 6-12-18, and 8-16-24). When used at comparable rates, the 1:3:3 ratio will supply more phosphorus, but, since this extra phosphorus usually is not needed, there is seldom justification for using it over the 1:2:3 ratio mixtures.

The cost per unit of nutrient in a high-analysis fertilizer is generally less than in lower-analysis grades. It is also less expensive for growers to handle the higher-analysis grades since they are used at lower rates.

FERTILIZER APPLICATION

Fertilizer should be placed in the soil so that it will not be in direct contact with the roots of newly set plants. Fertilizer injury is frequently the cause of poor stands and irregular crops. The two general methods of applying fertilizer are broadcast and row placement. Each has a place in the fertilization of dark-fired tobacco. On the heavier soils (e.g., Cecil, Lloyd, etc.) that have been well managed, all of the fertilizer can be broadcast and plowed or disked-in with good results. On the lighter textured soils (Appling), and soils testing Low to Medium in phosphorus and potassium, a part of the fertilizer should be placed in the row. If band placement equipment is available, place the fertilizer in two bands 8-10" apart and slightly deeper than the plant root crowns. Since it is difficult to set the transplants between the bands when the fertilization and transplanting operations are done separately, a combination fertilizer distributor-transplanter is recommended. If band placement equipment is not available, place the fertilizer so that it will be 3-5" below the root crown.

SIDEDRESSING

Many dark-fired tobacco producers choose tc apply all the fertilizer preplant and do not sidedress at all. This is generally acceptable on heavier textured soils where leaching losses are minimal. However, compounds present in fertilizers are relatively soluble in soil water; therefore, the salt concentrations surrounding fertilizer bands may be high enough to injure plants if all the required fertilizer is applied in the row before planting. Many growers choose to apply a part of the fertilizer at planting time and the remainder as a sidedressing after planting. On lighter textured soils, this is a good practice to insure that the fertilizer is not leached from the soil too rapidly. Nitrogen can be lost easily by leaching from sandy soils, and sidedressing a portion of the nitrogen application and adjustments for leaching are often necessary.

Tobacco should be sidedressed early--i.e., during the first two or three weeks that the tobacco is in the field. This will insure that sufficient nutrients are available for the crop just before it normally makes its most rapid growth (this period is generally during the second month the plants are in the field).

Research has shown that there is no advantage to sidedressing with fertilizers containing phosphorus. The most commonly used sidedressing materials are nitrogen fertilizers such as ammonium nitrate or fertilizers containing both nitrogen and potash (e.g., 15-0-15, 8-0-24, etc.) It is very important that nitrogen fertilizer used as a sidedressing contain at least 50% nitrate-nitrogen.

LIME RECOMMENDATIONS

Your Soil Test Report contains information on the amount of lime needed to adjust the pH of the soil to 5.5 - 6.0 for optimum tobacco production. Lime application according to soil test will lower the soil acidity and reduce exchangeable aluminum and

manganese, both of which can be toxic to plants. It will also increase the absorption of phosphorus and other nutrients and increase the supply of calcium and magnesium.

Lime is never suggested for tobacco except when a soil test indicates there is a need. Tobacco fields should not be overlimed because of the possibility of increasing certain disease problems (black root rot and black shank) and causing an imbalance of certain micronutrients.

FERTILIZING TOBACCO PLANT BEDS

Apply 50-75 lbs of 12-6-6 fertilizer per 100 sq yd and disk into the top 2 to 3" of soil. For further information on tobacco plant beds, refer to the publications listed below.

ADDITIONAL INFORMATION

Additional information may be obtained from your local VPI&SU Cooperative Extension Office. Publications available at present are:

SP-13. 1977 Virginia Dark-Fired Tobacco Production Guide.
Publication 197. Profitable Production of Fire-cured Tobacco.

Prepared by:
J.L. Jones, Extension Specialist, Tobacco
S.J. Donohue, Extension Specialist, Soil and Plant Analysis

VIRGINIA POLYTECHNIC INSTITUTE & STATE UNIVERSITY
EXTENSION DIVISION SOIL TESTING LABORATORY
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SOIL TEST NOTES
(Supplement to Soil Test Report)

NOTE 8. Sun-Cured Tobacco

FERTILIZER RECOMMENDATIONS

Your Soil Test Report contains information on the basic amounts of nitrogen, phosphorus, and potassium required for optimum growth of sun-cured tobacco according to the information you provided on the Soil Sample Information Sheet and the results of the laboratory tests. In making the recommendations, average soil and weather conditions and the use of high level-management practices are assumed.

An example of the grade or grades of fertilizer that will furnish the nutrients recommended is contained on the report. Other grades or combinations of grades that are available locally may be used if desired in meeting the crop's nutrient needs.

It should be noted that your past experience should be a major consideration in arriving at the final fertilizer rates to use. If manure is to be applied, you will want to refer to Soil Test Note 5 to determine the necessary adjustment in your fertilizer recommendations.

Do not apply excessive amounts of fertilizer indiscriminately. There has been a tendency for tobacco growers to use much higher rates of nitrogen, phosphorus, and potassium than can be expected to give profitable returns.

HIGH ANALYSIS FERTILIZER

The analysis of a fertilizer gives the percent of the different nutrients in the material or mixture. Two fertilizer grade ratios have been available for use on tobacco in Virginia--1:3:3 (3-9-9) and 1:2:3 (4-8-12, 5-10-15, 6-12-18, and 8-16-24). When used at comparable rates, the 1:3:3 ratio will supply more phosphorus, but, since this extra phosphorus usually is not needed, there is seldom justification for using it over the 1:2:3 ratio mixtures.

The cost per unit of nutrient in a high-analysis fertilizer is generally less than in lower-analysis grades. It is also less expensive for growers to handle the higher-analysis grades since they are used at lower rates.

FERTILIZER APPLICATION

Fertilizer should be placed in the soil so that it will not be in direct contact with the roots of newly set plants. Fertilizer injury is frequently the cause of poor stands and irregular crops. The two general methods of applying fertilizer are broadcast and row placement. Each has a place in the fertilization of sun-cured tobacco. On the heavier soils (e.g., Cecil, Lloyd, etc.) that have been well managed, all of the fertilizer can be broadcast and plowed or disked-in with good results. On the lighter textured soils (Appling), and soils testing Low to Medium, a part of the fertilizer should be placed in the row. If band placement equipment is available, place the fertilizer in two bands 8-10" apart and slightly deeper than the plant root crowns. Since it is difficult to set the transplants between the bands when the fertilization and transplanting operations are done separately, a combination fertilizer distributor-transplanter is recommended. If band placement equipment is not available, place the fertilizer so that it will be 3-5" below the root crown.

SIDEDRESSING

Many sun-cured tobacco producers choose tc apply all the fertilizer preplant and do not sidedress at all. This is generally acceptable on heavier textured soils where leaching losses are minimal. However, compounds present in fertilizers are relatively soluble in soil water; therefore, the salt concentrations surrounding fertilizer bands may be high enough to injure plants if all the required fertilizer is applied in the row before planting. Many growers choose to apply a part of the fertilizer at planting time and the remainder as a sidedressing after planting. On lighter textured soils this is a good practice to insure that the fertilizer is not leached from the soil too rapidly. Nitrogen can be lost easily by leaching from sandy soils, and sidedressing a portion of the nitrogen application and adjustments for leaching are often necessary.

Tobacco should be sidedressed early--i.e., during the first two or three weeks that the tobacco is in the field. This will insure that sufficient nutrients are available for the crop just before it normally makes its most rapid growth (this period is generally during the second month the plants are in the field).

Research has shown that there is no advantage to sidedressing with fertilizers containing phosphorus. The most commonly used sidedressers are nitrogen fertilizers such as ammonium nitrate or fertilizers containing both nitrogen and potash (ex. 15-0-15, 8-0-24, etc.) It is very important that nitrogen fertilizer used as a sidedressing contain at least 50% nitrate-nitrogen.

LIME RECOMMENDATIONS

Your Soil Test Report contains information on the amount of lime needed to adjust the pH of the soil to 5.5 - 6.0 for optimum tobacco production. Lime application according to soil test will lower the soil acidity and reduce exchangeable aluminum and manganese, both of which can be toxic to plants.

It will also increase the absorption of phosphorus and other nutrients and increase the supply of calcium and magnesium.

Lime is never suggested for tobacco except when a soil test indicates there is a need. Tobacco fields should not be overlimed because of the possibility of increasing certain disease problems (black root rot and black shank) and causing an imbalance of certain micronutrients.

FERTILIZING TOBACCO PLANT BEDS

Apply 50-75 lbs of 12-6-6 fertilizer per 100 sq yd and disk into the top 2 to 3" of soil. For further information on tobacco plant beds, contact your Extension agent.

ADDITIONAL INFORMATION

Additional information may be obtained from your local VPI&SU Cooperative Extension Office.

Prepared by:
J.L. Jones, Extension Specialist, Tobacco
S.J. Donohue, Extension Specialist, Soil and Plant Analysis

VIRGINIA POLYTECHNIC INSTITUTE & STATE UNIVERSITY
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SOIL TEST NOTES
(Supplement to Soil Test Report)

NOTE 9. Burley Tobacco

FERTILIZER RECOMMENDATIONS

Your Soil Test Report contains information on the basic amounts of nitrogen, phosphorus, and potassium required for optimum growth of burley tobacco according to the information you provided on the Soil Sample Information Sheet and the results of the laboratory tests. In making the recommendations, average soil and weather conditions and the use of high-level management practices are assumed.

An example of the grade or grades of fertilizer that will furnish the nutrients recommended is contained on the report. Other grades or combinations of grades that are available locally may be used if desired in meeting the crop's nutrient needs.

It should be noted that your experience and past results should be a major consideration in arriving at the final fertilizer rates to use. If manure is to be applied, you will want to refer to Soil Test Note 5 to determine the necessary adjustment in your fertilizer recommendations.

Fertilizing the crop according to soil test results will provide for maximum yields of good quality tobacco under average soil and weather conditions. Additional fertilizer may produce higher yields but probably no higher quality in years of ideal weather and with a high level of management. Yields may be reduced from causes other than lack of fertility, including poor weather conditions, disease and insect

infestation, poorly adapted soils, etc. These factors should be considered before investing in fertilizer in excess of the rates suggested.

HIGH ANALYSIS FERTILIZERS

The analysis of a fertilizer gives the percent of the different nutrients in the material or mixture. Two fertilizer grade ratios have been available for use on tobacco in Virginia--1:3:3 (3-9-9) and 1:2:3 (4-8-12, 5-10-15, 6-12-18, and 8-16-24). When used at comparable rates the 1:3:3 ratio will supply more phosphorus, but, since this extra phosphorus usually is not needed, there is seldom justification for using it over the 1:2:3 ratio mixtures.

The nutrients (unit cost) in a high-analysis fertilizer generally cost less than they do in lower-analysis grades. It is also less expensive for growers to handle the higher-analysis grades since they are used at lower rates.

SOIL ACIDITY LEVEL

Burley tobacco will grow satisfactorily over a wide range of soil acidity but other situations must be considered. The fungus which causes black root rot is favord by soil pH levels greater than 6.0. If the soil has a pH above 6.2, only a variety with good black root rot resistance should be grown, and preferably only one year in four on the same land. If the acidity level is below pH 4.9, injury and reduced yield from manganese toxicity can be expected. This is particulary true if the land is under intensive cultivation. Cultural methods that maintain pH in the range of 5.5 to 6.0 will minimize trouble with black root rot and manganese toxicity.

NITROGEN

The amount of available nitrogen in the soil cannot be routinely measured with present soil tests. In addition to the amount in the fertilizer, nitrogen supplied to the crop will be

influenced by past cropping, amount of organic matter, soil texture, and weather conditions. The amount of nitrogen suggested will be adequate for high yields (2700 pounds or over) on adapted soils and good growing conditions. The nitrogen supply for burley tobacco should be almost depleted at topping time or shortly after to allow for normal maturity of the tobacco and proper curing. An excess of nitrogen adds to curing difficulties and produces a tobacco that is less useful to manufacturers.

PHOSPHORUS

Tobacco uses relatively small amounts of phosphorus and does not respond to high levels of phosphorus fertilization. However, phosphorus becomes available rather slowly in comparison to nitrogen and potash, and, for this reason, it is desirable to maintain high levels in the soil. Phosphorus does not move readily or leach from the soil particles and thus, for the most part, it remains in the soil until used by growing crops. If the soil test shows a high level of phosphorus, an additional amount will neither benefit nor harm the immediate tobacco crop, but will increase the available supply in the soil for future crops.

POTASSIUM

Potassium is necessary not only for good growth but also enhances the quality of the tobacco. Tobacco deficient in potassium is more subject to leaf diseases in the field.

Muriate of potash should not be used for tobacco because of its chlorine content. Cured tobacco high in chlorine remains wet and is difficult to burn when used in manufacturing. Suitable potassium-supplying fertilizers are sulfate of potash (0-0-50), potassium nitrate (13-0-44), nitrate of soda-potash (15-0-14), and sulfate of potash magnesia (0-0-22 with 18% MgO).

Increasing the rate of potash above the suggested rate will not affect yield but tends to increase

quality. This effect is lost, however, unless additional care beyond that used by the average grower is used in housing, curing, and stripping.

SECONDARY ELEMENTS AND MICRONUTRIENTS

In addition to nitrogen, phosphorus, and potassium, burley tobacco requires the secondary elements of sulfur, calcium, and magnesium, and very minute amounts of the micronutrients boron, zinc, manganese, copper, iron, molybdenum, and chlorine.

Sulfur is amply supplied to tobacco as a naturally occurring element in the soil, as a constituent of rain water, and as a chemical compound used in the preparation of fertilizers.

Land which has recently been limed to reduce soil acidity, or has a pH above 5.5, should contain sufficient calcium for burley tobacco. It is not necessary to supply additional calcium in the form of fertilizer.

Since most tobacco fertilizers contain magnesium, and nearly all ground limestone contains some magnesium, this element will usually be supplied in adequate amounts through normal fertilizing and liming practices.

There is no evidence at this time to indicate that the application of micronutrients should become a general practice in the fertilization of burley tobacco. The soil types on which burley is produced contain these elements to some degree, and the pH level recommended favors their availability to the plant. Also, fertilizers contain varying quantities of these elements.

FERTILIZER APPLICATION

On a fertile soil, it makes little difference whether subsequent fertilizer applications are plowed-under or broadcast and disked-in after plowing. Row applications in excess of 500 pounds per acre of high-analysis mixed fertilizer should

not be used because of the danger of fertilizer injury to the roots.

Sidedressing burley tobacco is not generally recommended. However, sidedressing will be beneficial when nitrogen or potassium deficiency symptoms appear early in the season because of excessive rainfall or lack of fertilization before planting. Use about 50 pounds of nitrogen and/or 100 pounds of potash per acre incorporated into the soil by cultivation.

FERTILIZING TOBACCO PLANT BEDS

Apply 50-75 pounds of 12-6-6 fertilizer per 100 sq yd and disk into the top 2 to 3" of soil. For further information on tobacco plant beds, contact your Extension agent.

ADDITIONAL INFORMATION

Additional information may be obtained from your local VPI&SU Cooperative Extension Office.

Prepared by:
L.A. Link, Extension Specialist, Burley Tobacco
S.J. Donohue, Extension Specialist, Soil and Plant Analysis

VIRGINIA POLYTECHNIC INSTITUTE & STATE UNIVERSITY
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SOIL TEST NOTES
(Supplement to Soil Test Report)

NOTE 10. Commercial Apple Production

INTRODUCTION

Your Soil Test Report provides information on the amount of lime required for optimum growth. This Note contains information on apple fertilization as well as a discussion of other factors important in apple production.

LIME APPLICATION

The best time to adjust the soil pH in new orchards is before the trees are planted. Sufficient lime to bring the pH to 6.0-6.5 can be spread on the surface and plowed under. By plowing the lime down, the soil pH can be adjusted much more rapidly and to a greater depth than by surface application.

NITROGEN

The optimum amount of nitrogen to be applied is highly dependent on orchard conditions and should be adjusted on the basis of careful orchard observation. Perhaps the best time of year to evaluate the nitrogen status of an orchard is at harvest time. Indications of excessive nitrogen are terminal growth of more than 10-12", delayed and poor coloring of apples, and large, soft apples. Fruit from such blocks will have a reduced storage life, as well as inferior quality at harvest. Some blocks of trees which have not received nitrogen for several years may have these characteristics but that is unusual. Deficient nitrogen will cause reduced vegetative growth, with small, hard apples which color early for the

variety.

A rule of thumb for nitrogen application for mature trees is 20 to 40 pounds of elemental nitrogen per acre. The following amounts of various fertilizer materials will supply these nitrogen rates: calcium nitrate (15.5-0-0), 130-260 lbs.; nitrate of soda (16.5-0-0), 120-240 lbs.; ammonium nitrate (33-0-0), 60-120 lbs.; or urea (45-0-0), 45-90 lbs. If a broadcast application is made for the sod cover, then no additional nitrogen is needed during the year.

Foliar applications of nitrogen may be made to trees which were not fertilized or which show lighter leaf color than is considered desirable. Four lbs. of urea per 100 gallons of water is recommended for trees after bloom. This should not be applied after the first or second cover sprays because of the possibility of reduced color of the fruit.

As various orchard operations are changed, the nitrogen fertilization program should be adjusted accordingly. When herbicides are applied or cultivation is used to control competing vegetation, rates of nitrogen application should be reduced. By eliminating competition for nitrogen, the trees will receive a greater proportion of the amount applied.

The increasing use of mechanical pruning has also complicated the nitrogen situation. When severe pruning of any type is done, there is a decreased need for nitrogen since the top of the tree has been reduced in relation to the root system. Because an apple tree has a sizeable nitrogen storage capacity, the fertilizer application should be reduced or eliminated the year prior to severe pruning as well as the year following. Unless this is done, the symptoms of excessive nitrogen are very likely to occur. It is much more desirable to prevent this situation than to try to alleviate it.

PHOSPHORUS, POTASSIUM

As a general rule, there is little or nothing to be gained by fertilizing apple trees with either phosphorus or potassium in Virginia. Although no harm is likely to result, beneficial effects are quite unlikely. Phosphorus and potassium may, however, be needed for the sod.

BORON

Boron, a micronutrient, is necessary in small amounts. Boron-deficiency corking has been common over the years and seems to be worse in dry seasons. The symptoms include corky areas in the flesh of the fruit, often concentrated around the core area. The symptoms vary among varieties but are quite distinct from those of cork spot and bitter pit. When the symptoms become apparent in a particular year, it is too late to remedy the problem. Therefore, the best procedure is to prevent the disorder by either ground or foliar applications.

1. Ground Application of Boron. (Note: To avoid injury, do not use a ground application of boron on trees less than 3 years old. Do not apply boron at rates higher than recommended or near the trunk of young trees). If boron is not applied as a spray it may be applied as a ground application once every 3 years. The easiest method of soil application is broadcasting by machine, covering the entire soil surface. Equivalent boron application rates are as follows:

Material	Lbs/Acre*
Agricultural Borax (11.6% B)	30
Borate 46 (14.3% B)	24
Borate 65 (20.2%)	17

*Rates are designed to give the equivalent of approximately 3.5 pounds of boron per acre.

If boron is applied by hand, apply in about a 4' band at the drip line of the branches on older trees or in a band at a distance of 3 to 6' from the trunk of young trees. Apply on the basis of tree age or trunk diameter if applied by hand. Rates in ounces per tree are:

Tree or Age	Trunk Diameter 1Ft. Above Ground, Inches	Ounces of Borate 46	Ounces of Borate 65
1- 3		0	0
4- 6	3 1/2	1 1/2	1
7- 9	5	3	2
10-12	7	4	3
13-15	10	6	4
16-25+	14-15+	7-11	5-8

Preferably apply soil applications of boron in November or December. It may be applied in January to March but the later the application, the lower the availability of boron to the tree in the first growing season after application. If a soil application of boron is made in February or March, to help increase boron availability for that growing season, a spray of soluble boron is desirable in the bloom/petal fall period.

2. <u>Foliar Boron Application.</u> Two early-season soluble boron sprays, applied to trees of any age, may replace the need for a soil application of boron. Do not apply more than one soluble boron spray if boron has been applied to the soil during the previous fall or winter. Use the equivalent of 1.0 pound of Solubor (20% boron) per 100 gallons of dilute spray in each of two sprays applied during the full bloom, petal-fall, or first-cover spray periods. Soluble boron may be added to the spray tank with the regular pesticide spray.

CALCIUM

Low levels of calcium in apple fruits have been related to certain physiological disorders such as bitter pit and cork spot. Information on calcium application is found under the discussion of each of these disorders below.

BITTER PIT

Unlike cork spot which is present in Virginia apple orchards before harvest, bitter pit does not usually develop until after harvest. Bitter pit is evident as small, brown, soft pits of collapsed tissue. Most of the pitting is just beneath the apple skin and primarily in the blossom half of the apple.

A spray program for bitter pit often will not provide the degree of control desired without a modification of tree condition. Early harvest increases bitter pit.

Bitter pit development is largely the result of low calcium in the peel area of apples. It is difficult to increase the calcium supply to the fruit. However, application of calcium sprays before harvest reduces bitter pit.

To reduce bitter pit, use 3.0 to 4.0 pounds of calcium nitrate or 2.0 to 2.5 pounds of calcium chloride per 100 gallons of water, plus a wetting agent. Make four or five applications at 2-week intervals, starting 8 to 10 weeks before picking time. Make certain that each spray coverage is thorough, wetting the entire surface of the apples. Use of concentrate sprays of calcium may reduce response and may cause leaf injury.

Calcium nitrate or calcium chloride has been added to most pesticide mixtures without compatibility problems. To obtain such a spray, add the pesticides first, then the wetting agent, and then the calcium. Keep the tank mixture agitated while adding the calcium. Apply the spray preferably under good drying conditions. Do not apply it

when the air temperature is greater than 85 F. Use calcium chloride on Yorks or Mutsu because calcium nitrate may cause fruit surface injury.

CORK SPOT

Cork spot of apples is occasionally a problem in some blocks of trees. Cork spots are small to large brown spots of dead cells located near the surface or deep in the apple flesh. The spot area is firmer than the surrounding flesh. Cork spot forms during the growing season and does not develop after harvest.

An adequate level of boron and calcium in the fruit early in the season helps reduce the severity of cork spot later in the growing season. While adequate boron in the fruit will help reduce cork spot, it cannot control it. Where cork spot has been a problem, use two soluble boron sprays. Follow the recommendations under "Foliar Application of Boron".

Low calcium levels in apple fruit greatly increase the amount of cork spot. Calcium sprays increase fruit calcium content and aid in the reduction of cork spot. If calcium sprays are needed, apply them in at least the first four cover sprays or, preferably, in all of the cover sprays. Use 2.0 to 2.5 pounds of calcium choride per 100 gallons. Use a wetting agent to aid in spreading and sticking. Add calcium chloride last to the spray tank. The use of calcium in concentrate sprays has occasionally caused some leaf injury and reduced response. Do not apply a calcium spray if the air temperature is above 85 F.

In blocks with a history of cork spot, fruit calcium levels may be so low that sprays are ineffective. Cultural practices should then be modified in order to reduce the development of the disorder.

SOIL MANAGEMENT CONSIDERATIONS

It is desirable to maintain a permanent sod in a bearing apple orchard. Quite commonly, this soil management system may be supplemented by herbicides in the tree row. Because of the somewhat different needs of the sod and trees, it is recommended that they be fertilized separately. A general rule of thumb for maintaining a good sod is to use approximately 300-400 pounds per acre of a 10-10-10 fertilizer broadcast every third year. If the sod cover shows plenty of vigor, this rate can be reduced or the interval between applications extended. Whereas an apple tree will generally not respond to either phosphorus or potassium, a sod cover commonly will. In a year when this broadcast application is made, no additional nitrogen should be applied to the trees.

ADDITIONAL INFORMATION

Additional information may be obtained from your local VPI & SU Cooperative Extension Office. Publications available at present are:

Publication. 595. Production Management Practices for Apples, Peaches and Nectarines.
Publication. 219. 1978 Virginia Spray Bulletin for Commercial Tree Fruit Growers

Prepared by:
G.R. Williams, Extension Specialist, Horticulture
S. J. Donohue, Extension Specialist, Soil and Plant Analysis

VIRGINIA POLYTECHNIC INSTITUTE & STATE UNIVERSITY
EXTENSION DIVISION SOIL TESTING LABORATORY
MA-241 April, 1979

SOIL TEST NOTES
(Supplement to Soil Test Report)

NOTE 11. Commercial Peach Production

Your soil test report provides information on the amount of lime required for optimum growth and also indicates whether P_2O_5 or K_2O fertilizer will be needed. The suggested rates of P_2O_5 and K_2O to apply are listed in this leaflet, along with the recommended N fertilizer rates.

PREPLANTING

If the P_2O_5 or K_2O soil test indicates Low, use the following table to determine the type and amount of fertilizer to use.

Soil Test Results	Fertilizer to Use	Amount to Apply (lbs./A)
Low P_2O_5	0-46- 0	100
Low K_2O	0- 0-60	100
Low P_2O_5 and K_2O	0-14-14	400
Medium or higher P_2O_5 and K_2O	None	None

Broadcast and plow-down or disk-in fertilizer before planting. Application of fertilizer at planting time is not recommended.

NON-BEARING TREES

1st Year

After growth has begun, usually about the first of April in Virginia, apply 0.15 lb. actual N around each tree. [Example - 1 lb. of nitrate of soda (16-0-0) per tree.]

2nd Year

Same as 1st year, using 0.3 lb. N.

3rd Year

1. Same as 1st year, using 0.45 lb. N.

2. Where terminal growth is excessive (40" or more), either reduce the amount per application or eliminate one or both of the later applications.

BEARING TREES

1. Apply annually 0.05 lb. actual N per year of tree's age up to a maximum of 1.0 lb. N per tree.

2. Reduce or increase rate of N application according to previous year's growth, 10 to 18" of terminal growth annually being considered limits for maximum economic production.

3. Nitrogen fertilizer may be applied either in the fall after leaves have fallen, or in early spring about 3 or 4 weeks before active growth begins. On light, sandy soil, it is best to delay application until early spring.

P2O5, K2O MAINTENANCE IN ESTABLISHED ORCHARDS
(Bearing and Non-Bearing Trees)

If the P2O5 soil test indicates Low, apply triple superphosphate (0-46-0) at 100 lbs. per acre. If the K2O soil test indicates Low, make an application of muriate of potash (0-0-60) at 100 lbs. per acre.

If both P2O5 and K2O soil test levels are Low, apply 0-14-14 at 400 lbs. per acre.

At Medium or higher P2O5 or K2O soil test levels, additional fertilizer applications are normally

not necessary.

The P2O5 and K2O fertilizer may be applied either in the fall after leaves have fallen, or in early spring about 3 or 4 weeks before active growth begins.

Under cover crop culture, apply complete fertilizer as required for cover in the fall with nitrogen only to the tree in spring.

ADDITIONAL INFORMATION

Additional information may be obtained from your local VPI&SU Cooperative Extension Office.

Prepared by:
S.J. Donohue, Extension Specialist, Soil and Plant Analysis
D.C. Coston, Extension Fruit Specialist

VIRGINIA POLYTECHNIC INSTITUTE & STATE UNIVERSITY
EXTENSION DIVISION SOIL TESTING LABORATORY
MA-242 April, 1979

SOIL TEST NOTES
(Supplement to Soil Test Report)

NOTE 12. Commercial Forest Tree Crops

INTRODUCTION

The guidelines for commercial forest tree fertilization contained in this note are adapted from material published by the North Carolina Department of Agriculture Soil Testing Division and are based on work conducted by the Southern Forest Tree Fertilization Cooperative.

LIME

Spread the amount of lime suggested in the Soil Test Report as the land is prepared. This application should be adequate for 3 to 5 years. The rates suggested are made for establishment. Little benefit can be expected from amounts in excess of 2 tons per acre if the application is made on the surface. Never apply limestone without first determining the need for it by a soil test. Too much may be as harmful as too little.

TREE NURSERIES AND BLACK WALNUTS

Before establishment, apply the suggested nitrogen, phosphate, and potash and mix thoroughly with the soil. One week to 10 days should pass before setting the trees to give the fertilizer time to react with the soil.

For maintenance, pine nurseries will usually need 50 to 100 pounds of additional nitrogen; spruce, fir, white pine, and hardwood nurseries will need an additional 75 to 125 pounds of nitrogen. The nitrogen should be topdressed in several

applications and may be applied through the irrigation system. Black walnut stands should be topdressed with 75 to 125 pounds of nitrogen annually.

SEED ORCHARDS

Use the rates of fertilizer suggested for establishment of tree nurseries and black walnuts. Be sure the fertilizer is well mixed with the soil before planting because young seedlings are very sensitive to fertilizer injury. It is desirable to allow one week to 10 days between the application of the fertilizer and the seeding of the plants to allow sufficient time for the fertilizer to react thoroughly with the soil.

Use the same rates annually for maintenance until the trees are 4 years old. Broadcast the fertilizer in the early spring but do not allow the fertilizer to come in contact with the base of the tree. For trees more than 4 years old, topdress with an additional 60 to 80 pounds of nitrogen per acre in July. Do not spread the fertilizer while the foliage is wet. Additional soil tests should be made to determine other nutrient needs at this time.

CHRISTMAS TREE ESTABLISHMENT

Use the same procedures and precautions in the establishment of Christmas trees as discussed above under establishment of seed orchards.

Maintenance - After Corrective Treatment at Planting. Maintenance fertilizers following the suggested corrective treatment at the time of establishment need contain only nitrogen. Broadcast the fertilizer material outside the limbspread and, if on a steep slope, on the lower side only.

2nd year - Apply 1/2 oz. nitrogen per tree.
3rd and 4th year - Apply 1 oz. nitrogen per tree.

5th year - If more than 2 summers before harvest, get another soil test and apply the suggested phosphate and potash along with 60 to 80 lbs. of nitrogen per acre or, if preferred, 1 oz. of nitrogen per tree. If projected harvest date is not more than two summers away, apply 1 oz. of nitrogen per tree each year before harvest.

Maintenance - Without Corrective Treatment at Planting. If projected harvest date is more than 2 years away, get a soil test and apply the corrective treatment suggested. Apply nitrogen at the rate of 1 oz. per tree the following spring and each year thereafter until harvest.

If projected harvest date is less than 2 summers away, apply nitrogen only at the rate of 1 oz. per tree each year until harvest.

Maintenance - Red Cedar. This species grows in the fall as well as in the spring. Additional growth and better color can be obtained by applying extra nitrogen after the trees are 4 years old. In addition to the early spring treatment indicated in the appropriate schedule outlined above, apply 2/3 oz. of nitrogen per tree in late July.

One ounce of nitrogen is contained in 3 ozs. of ammonium nitrate or 5 ozs. of ammonium sulfate.

Sulfur. This element may be in short supply in some soils used for Christmas trees. If determined or suspected to be deficient, ammonium sulfate can be used as the source of nitrogen, superphosphate as the source of phosphate, or calcium sulfate may be applied at the rate of 200 lbs. per acre.

TREE STANDS

Tree stands may be fertilized 10 years before the projected harvest date and again at the same rate 5 years before harvest, only if soil tests

indicate specific nutrient deficiencies. Although most trees respond to fertilization, insufficient evidence is available to support the economic feasibility of tree stand fertilization on a large scale.

ADDITIONAL INFORMATION

Additional information may be obtained from your local VPI&SU Cooperative Extension Office.

Prepared by:
H.L. Haney, Jr., Extension Specialist, Forest Management
D.W. Smith, Forestry
S.J. Donohue, Extension Specialist, Soil and Plant Analysis

VIRGINIA POLYTECHNIC INSTITUTE & STATE UNIVERSITY
EXTENSION DIVISION SOIL TESTING LABORATORY
MA-243 April, 1979

SOIL TEST NOTES
(Supplement to Soil Test Report)

NOTE 13. Commercial Greenhouse and Nursery Production

SOLUBLE SALTS

While soluble salts pose few problems for field soils, the confined soil systems and intensive fertilizer programs in container and bench crops create conditions where excessive salts may build up and cause poor growth. The Soil Test Report will indicate whether "leaching" or "partial leaching" is needed. The following are guidelines for leaching:

Partial Leaching - To avoid salt build-up, apply enough water at each watering (2 quarts per square foot) to have some run out the bottom of the bench or pot.

Complete Leaching - Apply 1-2 galloms of water per square foot of area or 1 quart per pot. After 30 to 90 minutes, repeat the application. Applying the water twice is important. The first watering dissolves the salts; the second carries the salts away. Where salts are excessively high, a third watering may be necessary.

MISCELLANEOUS FERTILIZER INFORMATION FOR GREENHOUSE PRODUCTION

1. Fertilizer Mixtures

   a. 1/2 lb. Potassium Nitrate plus 1/2 lb. Ammonium Nitrate = 1 lb. 23-0-23.

(Continued on Page 5)

(Continued from Page 1)

b. 1 lb. Potassium Nitrate = 1 lb. Potassium Chloride + 3/4 lb. Ammonium Sulfate

c. 1 lb. Ammo-phos (mono-ammonium phosphate) = 2 1/2 lb. Superphosphate + 1/2 lb. Ammonium Sulfate

d. 1 lb. Ammon-phos (mixture of mono- and di-ammonium phosphate) = 1 lb. Superphosphate + 5/6 lb. Ammonium Sulfate

2. For Potted Plants - Recommendations on the basis of 100 sq ft can be converted to pot plant applications by dissolving the recommended amount in 25 galloms of water and applying as a watering.

3. New Potting, Bench Soils Before Planting - Mix thoroughly 2 1/2 lbs. of 5-10-5 or 5-10-10 or 1 1/4 lbs. of 10-10-10 per 100 sq feet of bench area, or 2 oz. to 4 bushels of potting soil.

4. When a Proportioner is Used For Fertilizing - It is recommended that watering be dome at the rate of 1 gallon per 2 sq ft of bench area to ensure some leaching at each watering to avoid salt toxicity.

USEFUL CONVERSION FACTORS

1 bushel equals 1 1/4 cubic feet
1 cubic yard equals about 22 bushels (exactly 21.6 bushels) or 27 cubic ft
100 square feet of bench area (6 inch depth of soil) contains 50 cubic feet or 40 bushels or 1.85 cubic yards
1 pound per 100 square feet of soil (6 inches deep) equals 1 ounce per 2 1/2 bushels
1 acre is equal to 43,560 square feet
Pounds per 100 square feet x 436 equals pounds per acre
Pounds per 1000 square feet x 43.6 equals pounds per acre

1 gallon of concentrated liquid fertilizer weighs about 11 pounds
1 pint of dry fertilizer weighs about 1 pound
1 pint is equal to 2 cups or 32 tablespoons
1 tablespoon is equal to 3 teaspoons
1 ppm means 1 part per million
pp2m means parts per 2 million
An acre of mineral soil turned to a depth of 6-2/3 inches weighs about 2 million pounds
1 bushel is equivalent to 134 3-inch standard pots of loose, unpacked soil mix
1 bushel is equivalent to 58 4-inch standard pots of loose, unpacked soil mix
1 3-inch standard pot holds about 13 ounces of dolomitic limestone
1 4-inch standard pot holds about 2 lbs. 4 oz. of dolomitic limestone
Pounds per acre divided by 2 equals parts per million (Soil Test conversion factor)

ADDITIONAL INFORMATION

Additional information may be obtained from your local VPI&SU Cooperative Extension Office.

Prepared by:
S.J. Donohue, Extension Specialist, Soil and Plant Analysis
P.L. Smeal, Extension Specialist, Floriculture and Nursery Production

Table 3a. Common fertilizer materials for greenhouse crops.

MATERIAL	Nutrient Analysis: Nitrogen (N)		Phosphorus (P2O5)		Potassium (K2O)
NITROGEN (ACID REACTION)					
Ammonium Sulphate	20		0		0
Ammonium Nitrate		33.5		0	
Urea	42-46		0		0
NITROGEN (BASIC REACTION)					
Sodium Nitrate	16		0		0
Calcium Nitrate	17		0		0
Potassium Nitrate	12		0		44-46
PHOSPHORUS					
Treble Superphosphate	0		45		0
Monoammonium Phosphate	11		48		0
Diammonium Phosphate		21		54	
POTASSIUM					
Potassium Chloride (Muriate of Potash)	0		0		50-60
Potassium Nitrate	14		0		44-46
COMPLETE FERTILIZERS					
A. For dry application					
5-10-5 (or 5-10-10)	5		10		5
10-10-10	10		10		10
B. For liquid application					
20-20-20	20		20		20
20-5-30	20		5		30
CONTROLLED-RELEASE					
MagAmp	7		40		6
Osmocote		14		14	
Peters	14		7		7

Table 3b. Standard fertilizer application rates for greenhouse crops.

MATERIAL	STANDARD RATES: Bench Crops, Pounds Per 100 sq ft	Potted Pl., Pounds Per 25 Gallons of Water	Potting Soil, Ounces Per 2 1/2 Bushels of Soil*	Relative Availabilty
NITROGEN (ACID REACTION)				
Ammonium Sulphate	1 **	1/2	--	Rapid
Ammonium Nitrate	2/3 **	1/4	--	Rapid
Urea	1/2 **	1/4	--	Rapid
NITROGEN (BASIC REACTION)				
Sodium Nitrate	1 **	1/2	--	Rapid
Calcium Nitrate	1 **	1/2	--	Rapid
Potassium Nitrate	1/2 **	1/4	--	Rapid
PHOSPHORUS				
Treble Superphosphate	1 1/3-2 1/2	--	--	Slow
Monoammonium Phosphate	1 1/3 **	--	--	Rapid
Diammonium Phosphate	1 **	--	--	Rapid
POTASSIUM				
Potassium Chloride (Muriate of Potash)	1/2 **	1/4	--	Rapid
Potassium Nitrate	1/2 **	1/4	--	Rapid
COMPLETE FERTILIZERS				
A. For dry application				
5-10-5 (or 5-10-10)	2 1/2	--	2 1/2	Rapid
10-10-10	1 1/4	--	1 3/4	Rapid
B. For liquid application				
20-20-20	1/2-3/4**	1/2-3/4	--	Rapid
20-5-30	1/2-3/4**	1/2-3/4	--	Rapid
CONTROLLED-RELEASE				
MagAmp	10-15	--	9-18	Controlled
Osmocote	10	--	9	Controlled
Peters	10	--	9	Controlled

*One bushel equals 1 1/4 cubic feet.
**Satisfactory for liquid fertilizer or organic fertilizer.

VIRGINIA POLYTECHNIC INSTITUTE & STATE UNIVERSITY
EXTENSION DIVISION SOIL TESTING LABORATORY
MA-240 April, 1979

SOIL TEST NOTES
(Supplement to Soil Test Report)

NOTE 10. Commercial Apple Production

INTRODUCTION

Your Soil Test Report provides information on the amount of lime required for optimum growth. This Note contains information on apple fertilization as well as a discussion of other factors important in apple production.

LIME APPLICATION

The best time to adjust the soil pH in new orchards is before the trees are planted. Sufficient lime to bring the pH to 6.0-6.5 can be spread on the surface and plowed under. By plowing the lime down, the soil pH can be adjusted much more rapidly and to a greater depth than by surface application.

NITROGEN

The optimum amount of nitrogen to be applied is highly dependent on orchard conditions and should be adjusted on the basis of careful orchard observation. Perhaps the best time of year to evaluate the nitrogen status of an orchard is at harvest time. Indications of excessive nitrogen are terminal growth of more than 10-12", delayed and poor coloring of apples, and large, soft apples. Fruit from such blocks will have a reduced storage life, as well as inferior quality at harvest. Some blocks of trees which have not received nitrogen for several years may have these characteristics but that is unusual. Deficient nitrogen will cause reduced vegetative growth, with small, hard apples which color early for the

variety.

A rule of thumb for nitrogen application for mature trees is 20 to 40 pounds of elemental nitrogen per acre. The following amounts of various fertilizer materials will supply these nitrogen rates: calcium nitrate (15.5-0-0), 130-260 lbs.; nitrate of soda (16.5-0-0), 120-240 lbs.; ammonium nitrate (33-0-0), 60-120 lbs.; or urea (45-0-0), 45-90 lbs. If a broadcast application is made for the sod cover, then no additional nitrogen is needed during the year.

Foliar applications of nitrogen may be made to trees which were not fertilized or which show lighter leaf color than is considered desirable. Four lbs. of urea per 100 gallons of water is recommended for trees after bloom. This should not be applied after the first or second cover sprays because of the possibility of reduced color of the fruit.

As various orchard operations are changed, the nitrogen fertilization program should be adjusted accordingly. When herbicides are applied or cultivation is used to control competing vegetation, rates of nitrogen application should be reduced. By eliminating competition for nitrogen, the trees will receive a greater proportion of the amount applied.

The increasing use of mechanical pruning has also complicated the nitrogen situation. When severe pruning of any type is done, there is a decreased need for nitrogen since the top of the tree has been reduced in relation to the root system. Because an apple tree has a sizeable nitrogen storage capacity, the fertilizer application should be reduced or eliminated the year prior to severe pruning as well as the year following. Unless this is done, the symptoms of excessive nitrogen are very likely to occur. It is much more desirable to prevent this situation than to try to alleviate it.

PHOSPHORUS, POTASSIUM

As a general rule, there is little or nothing to be gained by fertilizing apple trees with either phosphorus or potassium in Virginia. Although no harm is likely to result, beneficial effects are quite unlikely. Phosphorus and potassium may, however, be needed for the sod.

BORON

Boron, a micronutrient, is necessary in small amounts. Boron-deficiency corking has been common over the years and seems to be worse in dry seasons. The symptoms include corky areas in the flesh of the fruit, often concentrated around the core area. The symptoms vary among varieties but are quite distinct from those of cork spot and bitter pit. When the symptoms become apparent in a particular year, it is too late to remedy the problem. Therefore, the best procedure is to prevent the disorder by either ground or foliar applications.

1. Ground Application of Boron. (Note: To avoid injury, do not use a ground application of boron on trees less than 3 years old. Do not apply boron at rates higher than recommended or near the trunk of young trees). If boron is not applied as a spray it may be applied as a ground application once every 3 years. The easiest method of soil application is broadcasting by machine, covering the entire soil surface. Equivalent boron application rates are as follows:

Material	Lbs/Acre*
Agricultural Borax (11.6% B)	30
Borate 46 (14.3% B)	24
Borate 65 (20.2%)	17

*Rates are designed to give the equivalent of approximately 3.5 pounds of boron per acre.

If boron is applied by hand, apply in about a 4' band at the drip line of the branches on older trees or in a band at a distance of 3 to 6' from the trunk of young trees. Apply on the basis of tree age or trunk diameter if applied by hand. Rates in ounces per tree are:

Tree or Age	Trunk Diameter 1Ft. Above Ground, Inches	Ounces of Borate 46	Ounces of Borate 65
1- 3		0	0
4- 6	3 1/2	1 1/2	1
7- 9	5	3	2
10-12	7	4	3
13-15	10	6	4
16-25+	14-15+	7-11	5-8

Preferably apply soil applications of boron in November or December. It may be applied in January to March but the later the application, the lower the availability of boron to the tree in the first growing season after application. If a soil application of boron is made in February or March, to help increase boron availability for that growing season, a spray of soluble boron is desirable in the bloom/petal fall period.

2. <u>Foliar Boron Application.</u> Two early-season soluble boron sprays, applied to trees of any age, may replace the need for a soil application of boron. Do not apply more than one soluble boron spray if boron has been applied to the soil during the previous fall or winter. Use the equivalent of 1.0 pound of Solubor (20% boron) per 100 gallons of dilute spray in each of two sprays applied during the full bloom, petal-fall, or first-cover spray periods. Soluble boron may be added to the spray tank with the regular pesticide spray.

CALCIUM

Low levels of calcium in apple fruits have been related to certain physiological disorders such as bitter pit and cork spot. Information on calcium application is found under the discussion of each of these disorders below.

BITTER PIT

Unlike cork spot which is present in Virginia apple orchards before harvest, bitter pit does not usually develop until after harvest. Bitter pit is evident as small, brown, soft pits of collapsed tissue. Most of the pitting is just beneath the apple skin and primarily in the blossom half of the apple.

A spray program for bitter pit often will not provide the degree of control desired without a modification of tree condition. Early harvest increases bitter pit.

Bitter pit development is largely the result of low calcium in the peel area of apples. It is difficult to increase the calcium supply to the fruit. However, application of calcium sprays before harvest reduces bitter pit.

To reduce bitter pit, use 3.0 to 4.0 pounds of calcium nitrate or 2.0 to 2.5 pounds of calcium chloride per 100 gallons of water, plus a wetting agent. Make four or five applications at 2-week intervals, starting 8 to 10 weeks before picking time. Make certain that each spray coverage is thorough, wetting the entire surface of the apples. Use of concentrate sprays of calcium may reduce response and may cause leaf injury.

Calcium nitrate or calcium chloride has been added to most pesticide mixtures without compatibility problems. To obtain such a spray, add the pesticides first, then the wetting agent, and then the calcium. Keep the tank mixture agitated while adding the calcium. Apply the spray preferably under good drying conditions. Do not apply it

when the air temperature is greater than 85 F. Use calcium chloride on Yorks or Mutsu because calcium nitrate may cause fruit surface injury.

CORK SPOT

Cork spot of apples is occasionally a problem in some blocks of trees. Cork spots are small to large brown spots of dead cells located near the surface or deep in the apple flesh. The spot area is firmer than the surrounding flesh. Cork spot forms during the growing season and does not develop after harvest.

An adequate level of boron and calcium in the fruit early in the season helps reduce the severity of cork spot later in the growing season. While adequate boron in the fruit will help reduce cork spot, it cannot control it. Where cork spot has been a problem, use two soluble boron sprays. Follow the recommendations under "Foliar Application of Boron".

Low calcium levels in apple fruit greatly increase the amount of cork spot. Calcium sprays increase fruit calcium content and aid in the reduction of cork spot. If calcium sprays are needed, apply them in at least the first four cover sprays or, preferably, in all of the cover sprays. Use 2.0 to 2.5 pounds of calcium choride per 100 gallons. Use a wetting agent to aid in spreading and sticking. Add calcium chloride last to the spray tank. The use of calcium in concentrate sprays has occasionally caused some leaf injury and reduced response. Do not apply a calcium spray if the air temperature is above 85 F.

In blocks with a history of cork spot, fruit calcium levels may be so low that sprays are ineffective. Cultural practices should then be modified in order to reduce the development of the disorder.

SOIL MANAGEMENT CONSIDERATIONS

It is desirable to maintain a permanent sod in a bearing apple orchard. Quite commonly, this soil management system may be supplemented by herbicides in the tree row. Because of the somewhat different needs of the sod and trees, it is recommended that they be fertilized separately. A general rule of thumb for maintaining a good sod is to use approximately 300-400 pounds per acre of a 10-10-10 fertilizer broadcast every third year. If the sod cover shows plenty of vigor, this rate can be reduced or the interval between applications extended. Whereas an apple tree will generally not respond to either phosphorus or potassium, a sod cover commonly will. In a year when this broadcast application is made, no additional nitrogen should be applied to the trees.

ADDITIONAL INFORMATION

Additional information may be obtained from your local VPI & SU Cooperative Extension Office. Publications available at present are:

Publication. 595. Production Management Practices for Apples, Peaches and Nectarines.
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Prepared by:
G.R. Williams, Extension Specialist, Horticulture
S. J. Donohue, Extension Specialist, Soil and Plant Analysis

VIRGINIA POLYTECHNIC INSTITUTE & STATE UNIVERSITY
EXTENSION DIVISION SOIL TESTING LABORATORY
MA-241 April, 1979

SOIL TEST NOTES
(Supplement to Soil Test Report)

NOTE 11. Commercial Peach Production

Your soil test report provides information on the amount of lime required for optimum growth and also indicates whether P_2O_5 or K_2O fertilizer will be needed. The suggested rates of P_2O_5 and K_2O to apply are listed in this leaflet, along with the recommended N fertilizer rates.

PREPLANTING

If the P_2O_5 or K_2O soil test indicates Low, use the following table to determine the type and amount of fertilizer to use.

Soil Test Results	Fertilizer to Use	Amount to Apply (lbs./A)
Low P_2O_5	0-46- 0	100
Low K_2O	0- 0-60	100
Low P_2O_5 and K_2O	0-14-14	400
Medium or higher P_2O_5 and K_2O	None	None

Broadcast and plow-down or disk-in fertilizer before planting. Application of fertilizer at planting time is not recommended.

NON-BEARING TREES

1st Year

After growth has begun, usually about the first of April in Virginia, apply 0.15 lb. actual N around each tree. [Example - 1 lb. of nitrate of soda (16-0-0) per tree.]

2nd Year

Same as 1st year, using 0.3 lb. N.

3rd Year

1. Same as 1st year, using 0.45 lb. N.

2. Where terminal growth is excessive (40" or more), either reduce the amount per application or eliminate one or both of the later applications.

BEARING TREES

1. Apply annually 0.05 lb. actual N per year of tree's age up to a maximum of 1.0 lb. N per tree.

2. Reduce or increase rate of N application according to previous year's growth, 10 to 18" of terminal growth annually being considered limits for maximum economic production.

3. Nitrogen fertilizer may be applied either in the fall after leaves have fallen, or in early spring about 3 or 4 weeks before active growth begins. On light, sandy soil, it is best to delay application until early spring.

P2O5, K2O MAINTENANCE IN ESTABLISHED ORCHARDS
(Bearing and Non-Bearing Trees)

If the P2O5 soil test indicates Low, apply triple superphosphate (0-46-0) at 100 lbs. per acre. If the K2O soil test indicates Low, make an application of muriate of potash (0-0-60) at 100 lbs. per acre.

If both P2O5 and K2O soil test levels are Low, apply 0-14-14 at 400 lbs. per acre.

At Medium or higher P2O5 or K2O soil test levels, additional fertilizer applications are normally

not necessary.

The P2O5 and K2O fertilizer may be applied either in the fall after leaves have fallen, or in early spring about 3 or 4 weeks before active growth begins.

Under cover crop culture, apply complete fertilizer as required for cover in the fall with nitrogen only to the tree in spring.

ADDITIONAL INFORMATION

Additional information may be obtained from your local VPI&SU Cooperative Extension Office.

Prepared by:
S.J. Donohue, Extension Specialist, Soil and Plant Analysis
D.C. Coston, Extension Fruit Specialist

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SOIL TEST NOTES
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NOTE 12. Commercial Forest Tree Crops

INTRODUCTION

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TREE NURSERIES AND BLACK WALNUTS

Before establishment, apply the suggested nitrogen, phosphate, and potash and mix thoroughly with the soil. One week to 10 days should pass before setting the trees to give the fertilizer time to react with the soil.

For maintenance, pine nurseries will usually need 50 to 100 pounds of additional nitrogen; spruce, fir, white pine, and hardwood nurseries will need an additional 75 to 125 pounds of nitrogen. The nitrogen should be topdressed in several

applications and may be applied through the irrigation system. Black walnut stands should be topdressed with 75 to 125 pounds of nitrogen annually.

SEED ORCHARDS

Use the rates of fertilizer suggested for establishment of tree nurseries and black walnuts. Be sure the fertilizer is well mixed with the soil before planting because young seedlings are very sensitive to fertilizer injury. It is desirable to allow one week to 10 days between the application of the fertilizer and the seeding of the plants to allow sufficient time for the fertilizer to react thoroughly with the soil.

Use the same rates annually for maintenance until the trees are 4 years old. Broadcast the fertilizer in the early spring but do not allow the fertilizer to come in contact with the base of the tree. For trees more than 4 years old, topdress with an additional 60 to 80 pounds of nitrogen per acre in July. Do not spread the fertilizer while the foliage is wet. Additional soil tests should be made to determine other nutrient needs at this time.

CHRISTMAS TREE ESTABLISHMENT

Use the same procedures and precautions in the establishment of Christmas trees as discussed above under establishment of seed orchards.

Maintenance - After Corrective Treatment at Planting. Maintenance fertilizers following the suggested corrective treatment at the time of establishment need contain only nitrogen. Broadcast the fertilizer material outside the limbspread and, if on a steep slope, on the lower side only.

2nd year - Apply 1/2 oz. nitrogen per tree.
3rd and 4th year - Apply 1 oz. nitrogen per tree.

5th year - If more than 2 summers before harvest, get another soil test and apply the suggested phosphate and potash along with 60 to 80 lbs. of nitrogen per acre or, if preferred, 1 oz. of nitrogen per tree. If projected harvest date is not more than two summers away, apply 1 oz. of nitrogen per tree each year before harvest.

Maintenance - Without Corrective Treatment at Planting. If projected harvest date is more than 2 years away, get a soil test and apply the corrective treatment suggested. Apply nitrogen at the rate of 1 oz. per tree the following spring and each year thereafter until harvest.

If projected harvest date is less than 2 summers away, apply nitrogen only at the rate of 1 oz. per tree each year until harvest.

Maintenance - Red Cedar. This species grows in the fall as well as in the spring. Additional growth and better color can be obtained by applying extra nitrogen after the trees are 4 years old. In addition to the early spring treatment indicated in the appropriate schedule outlined above, apply 2/3 oz. of nitrogen per tree in late July.

One ounce of nitrogen is contained in 3 ozs. of ammonium nitrate or 5 ozs. of ammonium sulfate.

Sulfur. This element may be in short supply in some soils used for Christmas trees. If determined or suspected to be deficient, ammonium sulfate can be used as the source of nitrogen, superphosphate as the source of phosphate, or calcium sulfate may be applied at the rate of 200 lbs. per acre.

TREE STANDS

Tree stands may be fertilized 10 years before the projected harvest date and again at the same rate 5 years before harvest, only if soil tests

indicate specific nutrient deficiencies. Although most trees respond to fertilization, insufficient evidence is available to support the economic feasibility of tree stand fertilization on a large scale.

ADDITIONAL INFORMATION

Additional information may be obtained from your local VPI&SU Cooperative Extension Office.

Prepared by:
H.L. Haney, Jr., Extension Specialist, Forest Management
D.W. Smith, Forestry
S.J. Donohue, Extension Specialist, Soil and Plant Analysis

VIRGINIA POLYTECHNIC INSTITUTE & STATE UNIVERSITY
EXTENSION DIVISION SOIL TESTING LABORATORY
MA-243 April, 1979

SOIL TEST NOTES
(Supplement to Soil Test Report)

NOTE 13. Commercial Greenhouse and Nursery Production

SOLUBLE SALTS

While soluble salts pose few problems for field soils, the confined soil systems and intensive fertilizer programs in container and bench crops create conditions where excessive salts may build up and cause poor growth. The Soil Test Report will indicate whether "leaching" or "partial leaching" is needed. The following are guidelines for leaching:

Partial Leaching - To avoid salt build-up, apply enough water at each watering (2 quarts per square foot) to have some run out the bottom of the bench or pot.

Complete Leaching - Apply 1-2 galloms of water per square foot of area or 1 quart per pot. After 30 to 90 minutes, repeat the application. Applying the water twice is important. The first watering dissolves the salts; the second carries the salts away. Where salts are excessively high, a third watering may be necessary.

MISCELLANEOUS FERTILIZER INFORMATION FOR GREENHOUSE PRODUCTION

1. Fertilizer Mixtures

   a. 1/2 lb. Potassium Nitrate plus 1/2 lb. Ammonium Nitrate = 1 lb. 23-0-23.

(Continued on Page 5)

(Continued from Page 1)

b. 1 lb. Potassium Nitrate = 1 lb. Potassium Chloride + 3/4 lb. Ammonium Sulfate

c. 1 lb. Ammo-phos (mono-ammonium phosphate) = 2 1/2 lb. Superphosphate + 1/2 lb. Ammonium Sulfate

d. 1 lb. Ammon-phos (mixture of mono- and di-ammonium phosphate) = 1 lb. Superphosphate + 5/6 lb. Ammonium Sulfate

2. For Potted Plants - Recommendations on the basis of 100 sq ft can be converted to pot plant applications by dissolving the recommended amount in 25 galloms of water and applying as a watering.

3. New Potting, Bench Soils Before Planting - Mix thoroughly 2 1/2 lbs. of 5-10-5 or 5-10-10 or 1 1/4 lbs. of 10-10-10 per 100 sq feet of bench area, or 2 oz. to 4 bushels of potting soil.

4. When a Proportioner is Used For Fertilizing - It is recommended that watering be dome at the rate of 1 gallon per 2 sq ft of bench area to ensure some leaching at each watering to avoid salt toxicity.

USEFUL CONVERSION FACTORS

1 bushel equals 1 1/4 cubic feet
1 cubic yard equals about 22 bushels (exactly 21.6 bushels) or 27 cubic ft
100 square feet of bench area (6 inch depth of soil) contains 50 cubic feet or 40 bushels or 1.85 cubic yards
1 pound per 100 square feet of soil (6 inches deep) equals 1 ounce per 2 1/2 bushels
1 acre is equal to 43,560 square feet
Pounds per 100 square feet x 436 equals pounds per acre
Pounds per 1000 square feet x 43.6 equals pounds per acre

1 gallon of concentrated liquid fertilizer weighs about 11 pounds
1 pint of dry fertilizer weighs about 1 pound
1 pint is equal to 2 cups or 32 tablespoons
1 tablespoon is equal to 3 teaspoons
1 ppm means 1 part per million
pp2m means parts per 2 million
An acre of mineral soil turned to a depth of 6-2/3 inches weighs about 2 million pounds
1 bushel is equivalent to 134 3-inch standard pots of loose, unpacked soil mix
1 bushel is equivalent to 58 4-inch standard pots of loose, unpacked soil mix
1 3-inch standard pot holds about 13 ounces of dolomitic limestone
1 4-inch standard pot holds about 2 lbs. 4 oz. of dolomitic limestone
Pounds per acre divided by 2 equals parts per million (Soil Test conversion factor)

ADDITIONAL INFORMATION

Additional information may be obtained from your local VPI&SU Cooperative Extension Office.

Prepared by:
S.J. Donohue, Extension Specialist, Soil and Plant Analysis
P.L. Smeal, Extension Specialist, Floriculture and Nursery Production

Table 3a. Common fertilizer materials for greenhouse crops.

MATERIAL	Nutrient Analysis: Nitrogen (N)		Phosphorus (P2O5)		Potassium (K2O)
NITROGEN (ACID REACTION)					
Ammonium Sulphate	20		0		0
Ammonium Nitrate		33.5		0	
Urea	42-46		0		0
NITROGEN (BASIC REACTION)					
Sodium Nitrate	16		0		0
Calcium Nitrate	17		0		0
Potassium Nitrate	12		0		44-46
PHOSPHORUS					
Treble Superphosphate	0		45		0
Monoammonium Phosphate	11		48		0
Diammonium Phosphate		21		54	
POTASSIUM					
Potassium Chloride (Muriate of Potash)	0		0		50-60
Potassium Nitrate	14		0		44-46
COMPLETE FERTILIZERS					
A. For dry application					
5-10-5 (or 5-10-10)	5		10		5
10-10-10	10		10		10
B. For liquid application					
20-20-20	20		20		20
20-5-30	20		5		30
CONTROLLED-RELEASE					
MagAmp	7		40		6
Osmocote		14		14	
Peters	14		7		7

Table 3b. Standard fertilizer application rates for greenhouse crops.

MATERIAL	STANDARD RATES: Bench Crops, Pounds Per 100 sq ft	Potted Pl., Pounds Per 25 Gallons of Water	Potting Soil, Ounces Per 2 1/2 Bushels of Soil*	Relative Availabilty
NITROGEN (ACID REACTION)				
Ammonium Sulphate	1 **	1/2	--	Rapid
Ammonium Nitrate	2/3 **	1/4	--	Rapid
Urea	1/2 **	1/4	--	Rapid
NITROGEN (BASIC REACTION)				
Sodium Nitrate	1 **	1/2	--	Rapid
Calcium Nitrate	1 **	1/2	--	Rapid
Potassium Nitrate	1/2 **	1/4	--	Rapid
PHOSPHORUS				
Treble Superphosphate	1 1/3-2 1/2	--	--	Slow
Monoammonium Phosphate	1 1/3 **	--	--	Rapid
Diammonium Phosphate	1 **	--	--	Rapid
POTASSIUM				
Potassium Chloride (Muriate of Potash)	1/2 **	1/4	--	Rapid
Potassium Nitrate	1/2 **	1/4	--	Rapid
COMPLETE FERTILIZERS				
A. For dry application				
5-10-5 (or 5-10-10)	2 1/2	--	2 1/2	Rapid
10-10-10	1 1/4	--	1 3/4	Rapid
B. For liquid application				
20-20-20	1/2-3/4**	1/2-3/4	--	Rapid
20-5-30	1/2-3/4**	1/2-3/4	--	Rapid
CONTROLLED-RELEASE				
MagAmp	10-15	--	9-18	Controlled
Osmocote	10	--	9	Controlled
Peters	10	--	9	Controlled

*One bushel equals 1 1/4 cubic feet.
**Satisfactory for liquid fertilizer or organic fertilizer.

VIRGINIA POLYTECHNIC INSTITUTE & STATE UNIVERSITY
EXTENSION DIVISION SOIL TESTING LABORATORY
MA-244 April, 1979

SOIL TEST NOTES
(Supplement to Soil Test Report)

NOTE 14. Fairways, Large Industrial Lawns, Athletic Fields, Sod Production

ESTABLISHMENT VS MAINTENANCE FERTILIZATION

The P2O5 and K2O recommendations and times of application on your Soil Test Report are primarily for maintenance of established turf. For establishment of new turf, refer to one of the following publications for fertilizer recommendations: Fairways, Large Industrial Lawns - MA-122, Turf Management on Tall Fescue and/or Kentucky Bluegrass Athletic Fields - MA-213; Turf Management on Bermudagrass Athletic Fields - MA-214; Sod Production - MA-130.

Applying Lime

If you are establishing new turf, incorporate the entire recommended amount of lime into the soil before seeding or sodding. If you are maintaining established turf, and if the recommendation calls for less than 1 ton of lime per acre, apply the entire amount right away. If the recommendation is for more than 1 ton of lime, apply in several applications of up to 1 ton each, at intervals of 1 to 6 months, until the full amount is applied. Applying more than 1 ton per acre at any one time may cause a visible residue to remain on the turf for a prolonged period.

N FERTILIZATION - FAIRWAYS AND LARGE INDUSTRIAL LAWNS

Bluegrass and Other Cool Season Grasses		Bermudagrass	
When to Apply	Actual N lbs./A	When to Apply	Actual N lbs./A
September	40 - 60	March-April	40 - 60
Oct. 15-Nov. 15	60	May 15-June	60
June*	20 - 30	July 15-Aug. 10	40

*Apply only if needed for adequate growth and color.

N FERTILIZATION - ATHLETIC FIELDS

Ky Bluegrass and Tall Fescue		Bermudagrass*	
When to Apply	Actual N lbs./A	When to Apply	Actual N lbs./A
August	40 - 60	April	40 - 60
Sept.-Oct.	40 - 60	June	40 - 60
Nov.-Dec.	40 - 60	August (early)	30 - 40
May 20-June**	0 - 30		

* Additional N applications at similar rates may be made in May and July if turf growth and color indicate a need. Unless the bermudagrass is overseeded with a cool season grass, N fertilization should be avoided after August. If the bermudagrass is overseeded, then an additional application of 40-60 lbs. N/A will be needed in late October, and possibly in February, to stimulate the overseeded grass.

**Apply only if needed for adequate growth and color.

N FERTILIZATION - KY BLUEGRASS AND TALL FESCUE SOD PRODUCTION

When to Apply	N lbs./A
At Seeding	50 - 100
In Seeding Year:	
Nov. 15-Dec.	0 - 60*
First Year:	
May 15-June 15	20
Aug. 15-Oct. 1	40 - 60
Nov. 15-Dec. 31	40 - 60
Second Year:	20 - 30 as needed

*If 50 lbs. of N is used at seeding, apply additional N in late November or December.

ADDITIONAL INFORMATION

Additional Information may be obtained from your local VPI&SU Cooperative Extension Office. Publications available at present are:

MA-161. Maintenance of Tall Fescue and/or Kentucky Bluegrass Football Fields.
MA-166. Maintenance of Bermudagrass Football Fields.

Prepared by:
J.F. Shoulders, Extension Specialist, Turf
R.E. Schmidt, Associate Professor of Agronomy
S.J. Donohue, Extension Specialist, Soil and Plant Analysis

VIRGINIA POLYTECHNIC INSTITUTE & STATE UNIVERSITY
EXTENSION DIVISION SOIL TESTING LABORATORY
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SOIL TEST NOTES
(Supplement to Soil Test Report)

NOTE 15. Putting Greens.

ESTABLISHMENT VS MAINTENANCE FERTILIZATION

The P205 and K20 recommendations and times of application on your Soil Test Report are primarily for maintenance of established turf. If you are establishing new turf, refer to publication MA-79 (Construction of Golf Greens in Virginia) for information on fertilization.

APPLYING LIME

If you are establishing new turf, incorporate the entire recommended amount of lime into the soil before seeding or sodding. If you are maintaining established turf, and if the recommendation calls for less than 50 pounds of lime per 1000 square feet, apply the entire amount right away. If the recommendation is for more than 50 pounds of lime, apply in several applications of up to 50 pounds each at intervals of 1 to 6 months, until the full amount is applied. Applying more than 50 pounds per 1000 sq.ft. at any one time may cause a visible residue to remain on the turf for a prolonged period.

N PROGRAMS FOR GREENS - BENTGRASS

Bentgrass putting greens in Virginia will normally require from approximately 6 to 12 lbs. of actual nitrogen (N) per 1000 sq. ft. annually. Following are examples of programs which will supply N in adequate quantity and at the best time for most satisfactory bentgrass performance on greens constructed with conventional topsoil mixtures. These programs have been developed for

conventional greens topsoil mixtures and are not intended for greens mixtures consisting of sand and peat alone. Although each of the programs is generally adequate to provide satisfactory response from bentgrass, an equally adequate nitrogen program may be developed using combinations of the three programs.

Program A - Bentgrass*

Slowly available in warm weather, unavailable in winter.

Sources: Urea-formaldehyde-38%N (Nitroform, Uramite, Borden's 38, Vertamite)

When to Apply	Actual Nitrogen(N) lbs./1000 sq.ft.
September	4 to 5
November	1 to 1 1/2**
Mid-Dec. to Mid-Jan.	1 to 1 1/2**
May	2 to 3
TOTAL	9 to 12

* For Program A, 1/4 to 1/2 lb. of actual N from a quickly available source of nitrogen may be applied occasionally if needed to improve color. Use the lower rate during hot weather and always water-in thoroughly immediately after application.

**From natural organic or quickly available sources.

Program B - Bentgrass

Intermediately available in both warm and cool weather.

Sources: Natural Organic (Activated sewage sludge, IBDU, and other natural organic sources)

When to Apply	Actual Nitrogen(N) lbs./1000 sq.ft.
September	1 to 2
October	2
Nov. - Dec.	2
Mid-Dec. to Mid-Jan.	2
May	1 to 2
June	0 to 1
TOTAL	8 to 11

Program C - Bentgrass*

Quickly Available

Sources: ANL, ammonium nitrate, urea, etc.

When to Apply	Actual Nitrogen(N) lbs./1000 sq.ft.
September	1
October	1 to 1 1/2
November	1 to 1 1/2
December	1 to 1 1/2
Mid-Jan.	1 to 1 1/2
May	1
June	1/2
TOTAL	6 1/2 to 8

*Exercise caution in the use of quickly available nitrogen sources on established putting greens because of the danger of burning. Do not exceed the rate listed for the specific time of application. Spread uniformly, and always water-in thoroughly immediately following application.

IRON

Foliar application of iron during the fall, winter, and summer seasons will improve color, vigor and root growth (more resistance to desiccation). Three to four foliar applications of two ounces of iron sulphate or iron chelate per 1000 sq. ft. during fall and winter, and another three to four applications during summer at the same rate, will give maximum results. Applications of iron in winter if turf is brownish may result in a gray-green appearance. Avoid use of iron from March to June, since little, if any, benefit will result.

N PROGRAMS FOR GREENS - BERMUDAGRASS

Bermudagrass putting greens in Virginia, taking into account the grass overseeded for winter play, will normally require from approximately 8 to 12 lbs. of actual nitrogen(N) per 1000 sq.ft. annually. Following are examples of programs which will supply N in adequate quantity and at the best time for most satisfactory bermudagrass performance. Although each is generally adequate to provide satisfactory response from bermudagrass, an equally adequate nitrogen program may be developed using combinations of the three programs. If greens are not overseeded, do not apply nitrogen during the fall or winter.

Program A - Bermudagrass*

Slowly available in warm weather, unavailable in winter.

Sources: Urea-formaldehyde-38%N (Nitroform, Uramite, Borden's 38, Vertanite)

When to Apply	Actual Nitrogen(N) lbs./1000 sq.ft.
April	4 to 6
Sept. - Oct.	4**
November	0 to 1+
December	0 to 1+
February	1+
TOTAL	9 to 12

* For Program A, 1/4 to 1/2 lb. of actual N from a quickly available source of nitrogen may be applied occasionally if needed to improve the color. Use the lower rate during hot weather and always water-in thoroughly immediately after application.

**Apply after overseeding.

+ From quickly available or natural organic sources.

Program B - Bermudagrass

Intermediately available in both warm and cool weather.

Sources: Natural Organic (Activated sewage sludge, IBDU, and other natural organic sources)

When to Apply	Actual Nitrogen(N) lbs./1000 sq.ft.
April	2 to 3
June 1-15	2 to 3
July 15-30	2
Sept. - Oct.	1 to 2*
December	0 to 1
February	1
TOTAL	8 to 12

*Apply after overseeding.

Program C - Bermudagrass*
Quickly Available
Sources: ANL, ammonium nitrate, urea, etc.

When to Apply	Actual Nitrogen(N) lbs./1000 sq.ft.
April	1 to 1 1/2
May 1	1 to 1 1/2
June 1	1/2 to 1
June 15	1/2 to 1
July 1	1/2 to 1
July 15	1/2 to 1
August 15	1
Sept. - Oct.	1**
November	0 to 1
December	1
February	1
TOTAL	8 to 12

* It is best to avoid the use of quickly available nitrogen sources for established putting greens during extremely hot weather because of the danger of burning. If used, do not exceed the rate listed for the specific time of application, be certain to spread uniformly, and always water-in thoroughly immediately following application.

**Apply after overseeding.

ADDITIONAL INFORMATION

Additional information may be obtained from your local VPI&SU Cooperative Extension Office.

Prepared by:
J.F. Shoulders, Extension Specialist, Turf
R.E. Schmidt, Associate Professor of Agronomy
S.J. Donohue, Extension Specialist, Soil and Plant Analysis

VIRGINIA POLYTECHNIC INSTITUTE & STATE UNIVERSITY
EXTENSION DIVISION SOIL TESTING LABCRATORY
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SOIL TEST NOTES
(Supplement to Soil Test Report)

NOTE 16. Golf Tees

ESTABLISHMENT VS MAINTENANCE FERTILIZATION

The P2O5 and K2O recommendations and times of applications on your Soil Test Report are primarily for maintenance of established turf. If you are establishing new turf, refer to MA-200 (Lawn and Turf Establishment) for information on fertilization.

APPLYING LIME

If you are establishing new turf, incorporate the entire recommended amount of lime into the soil before seeding or sodding. If you are maintaining established turf, and if the recommendation calls for less than 50 pounds of lime per 1000 square feet, apply the entire amount right away. If the recommendation is for more than 50 pounds of lime, apply in several applications of up to 50 pounds each at intervals of 1 to 6 months, until the full amount is applied. Applying more than 50 pounds per 1000 square feet at any one time may cause a visible residue to remain on the turf for a prolonged period.

N PROGRAMS FOR TEES - BLUEGRASS, BENTGRASS RYEGRASS

The following are examples of programs which will supply N in adequate quantity and at the best time for most satisfactory performance of cool-season turfgrasses.

Program A - Bluegrass, Bentgrass, Ryegrass
Slowly Available N
(More Than 50% WIN)

Time of Application	N lbs./1000 sq.ft.
Aug. 15-Oct. 1	3 to 4
May 20-June 30	0 to 1 1/2
TOTAL	3 to 5 1/2

Program B - Bluegrass, Bentgrass, Ryegrass
Readily Available N
(Less Than 50% WIN)

Time of Application	N lbs./1000 sq.ft.
Aug. 15-Sept. 15	1 to 1 1/2
Oct. 1-Nov.1	1 to 1 1/2
Dec.	1 to 1 1/2
May 20-June 30	0 to 1/2
TOTAL	3 to 5

N PROGRAMS FOR TEES - BERMUDAGRASS

The following are examples of programs which will supply N in adequate quantity and at the best time for most satisfactory performance of bermudagrass.

Program A - Bermudagrass
Slowly Available N
(More Than 50% WIN)

Time of Application	N lbs./1000 sq.ft.
Sept. 1-Oct. 15*	0 to 3
March 1-April 15	4
TOTAL	4 to 7

*Apply during these dates or after overseeding.

Program B - Bermudagrass
Readily Available N
(Less Than 50% WIN)

Time of Application	N lbs./1000 sq. ft.
Oct. 1-Oct. 15	0 to 1 1/2
March 1-April 1	1/2
May 1-June 1	1 1/2
July 1-Aug. 1	1 to 1 1/2
TOTAL	4 to 6

*Apply during these dates or after overseeding.

ADDITIONAL INFORMATION

Additional information may be obtained from your local VPI&SU Cooperative Extension Office.

Prepared by:
J.F. Shoulders, Extension Specialist, Turf
R.E. Schmidt, Associate Professor of Agronomy
S.J. Donohue, Extension Specialist, Soil and Plant Analysis

VIRGINIA POLYTECHNIC INSTITUTE & STATE UNIVERSITY
EXTENSION DIVISION SOIL TESTING LABORATORY
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SOIL TEST NOTES
(Supplement to Soil Test Report)

NOTE 17. Maintaining Kentucky Bluegrass and Fescue Lawns

APPLYING LIME TO ESTABLISHED LAWNS

If less than 50 lbs. of lime per 1000 sq. ft. is recommended, apply full amount of lime in one application. If more than 50 lbs. of lime per 1000 sq.ft is recommended, apply the lime in several applications of up to 50 lbs. each, at intervals of 1 to 6 months, until the full amount is applied. Applying more than 50 lbs. per 1000 sq. ft. at any one time may result in an undesirable residue on the turf.

REPAIR OF BARE SPOTS

Prepare bare spots for seeding, sodding, plugging or sprigging by raking soil so that approximately one inch of loose soil is on the surface. Mixing of topsoil and/or organic matter into these spots will help prepare these areas for seeding or vegetative establishment.

Apply the same amount and type of fertilizer and lime recommended for maintaiming your lawn. Rake the fertilizer and lime into the upper inch of loose soil.

After seeding, apply mulch to conserve moisture. Seeded areas and areas sodded, plugged, or sprigged should be watered immediately after seeding or planting. Watering should continue as long as necessary to obtain satisfactory germination and establishment.

FERTILIZER PROGRAMS FOR LAWN MAINTENANCE

The following programs give flexibility in deciding on the types of fertilizer to use to best meet your needs. Programs 1 and 2 utilize fertilizers which contain readily available nitrogen [i.e., less than 50% of the nitrogen is slowly available--listed as WIN (Water Insoluble Nitrogen) on the fertilizer bag]. Program 3 utilizes fertilizers which contain slowly available nitrogen [i.e., more than 50% of the nitrogen is slowly available (WIN)]. Also, Programs 1 and 3 supply the three major nutrients (nitrogen, phosphate, potash) on a continuous basis, while Program 2 supplies the three major nutrients one time per year with nitrogen-only being applied the remainder of the time.

If used properly, any of the three programs will result in quality turf. Choose the program best suited to your needs and the available fertilizer supply in your area.

SELECT AND FOLLOW ONE PROGRAM
FROM FOLLOWING PageS

ADDITIONAL INFORMATION

Additional information may be obtained from your local VPI&SU Cooperative Extension Office. Publications available at present are:

Publication 211. Turfgrass Guide
MA-168. Fertilizer Programs for Maintaining Kentucky Bluegrass and Fescue.
MA-200. Lawn and Turf Establishment.

Prepared by:
J.R. Hall, III, Extension Specialist, Turf
J.F. Shoulders, Extension Specialist, Turf
S.J. Donohue, Extension Specialist, Soil and Plant Analysis

PROGRAM 1

Fertilizers Containing Readily Available Nitrogen (0-50% WIN)

Type of Fertilizer: Complete (N, P2O5, K2O)

Time of Application*	Amount, Type of Fertilizer to Apply,** lbs. per 1000 sq. ft.
August 15 to September 15	8-12 lbs of 12-4-8 OR 5-7 1/2 lbs of 20-10-10 OR 4-6 lbs of 25-4-7
October 1 to November 15	8-12 lbs of 12-4-8 OR 5-7 1/2 lbs of 20-10-10 OR 4-6 lbs of 25-4-7
December	8-12 lbs of 12-4-8 OR 5-7 1/2 lbs of 20-10-10 OR 4-6 lbs of 25-4-7
May 20 to June 30	0-4 lbs of 12-4-8 OR 0-2 1/2 lbs of 20-10-10 OR 0-2 lbs of 25-4-7

* From August through December, the types and amount of fertilizer recommended are designed to supply 1 to 1 1/2 lbs of nitrogen per 1000 sq. ft. The May-June application supplies 0 to 1/2 lbs of nitrogen.

**Fertilizers listed are only examples of the types of fertilizers needed. Select a specialty turf fertilizer with a ratio similar tc those listed.

Program 1 - Additional Comments:

1. Readily available sources of nitrcgen may cause burning if applied at heavy rates or not watered-in thoroughly immediately following application. Do not apply more than the suggested rate in a single application.

2. The December application can be omitted under some conditions; for instance, if

soils are not subject to fast leaching or grass is making satisfactory growth.

3. If inadequate fertilizer was applied in late fall, 1/2 lb. of actual nitrogen may be applied in spring if turf color and growth indicate a need.

PROGRAM 2

Fertilizers Containing Readily Available Nitrogen (0-50% WIN)

Type of Fertilizer: Complete (N, P2O5, K2O) + N Only

Time of Application*	Amount, Type of Fertilizer to Apply, lbs per 1000 sq. ft.
Aug. 15 to Sept. 15	3-4 1/2 lbs ammonium nitrate OR 5-7 lbs ammonium nitrate lime OR 6-9 lbs nitrate of soda OR 2 1/2 -3 lbs urea
Oct. 1 to Nov. 15	10-15 lbs of 10-10-10 (or equivalent)
Dec.	3-4 1/2 lbs ammonium nitrate OR 5-7 lbs ammonium nitrate lime OR 6-9 lbs nitrate of soda OR 2 1/2 - 3 lbs urea
May 20 to June 30	0-1 1/2 lbs ammonium nitrate OR 0-2 1/2 lbs ammonium nitrate lime OR 0-3 lbs nitrate of soda OR 0-1 1/2 lbs urea

*From August through December, the types and amounts of fertilizer recommended are designed to supply 1 to 1 1/2 lbs of nitrogen per 1000 sq.ft. The May-June application supplies 0 to 1/2 lbs of nitrogen.

Program 2 - Additional Comments:

1. Readily available sources of nitrogen may

cause burning if applied at heavy rates or not watered-in thoroughly immediately following application. Do not apply more than the suggested rate in a single application.

2. The December application can be omitted under some conditions; for instance, if soils are not subject to fast leaching or grass is making satisfactory growth.

3. If inadequate fertilizer was applied in late fall, 1/2 lbs. of Actual N may be applied in spring if turf color and growth indicate a need.

PROGRAM 3
Fertilizers Containing Slowly Available Nitrogen (>50% WIN)
Type of Fertilizer: Complete (N, P2O5, K2O)

Time of Application*	Amount, Type of Fertilizer to Apply,** lbs per 1000 sq.ft.
Aug. 15 to Oct. 1	25 to 33 lbs of 12-4-8 OR 15 to 20 lbs of 20-10-10 OR 8 to 10 lbs of urea-formaldehyde (38-0-0) PLUS 4 to 8 lbs of 0-25-25 or equivalent
May 20 to June 30	0 to 4 lbs of urea-formaldehyde OR 0 to 12 lbs of 12-4-8 OR 0 to 7 1/2 lbs of 20-10-10

* The August-October application is designed to supply 3 to 4 lbs of nitrogen per 1000 sq.ft. The May-June application supplies 0 to 1 1/2 lbs of nitrogen per 1000 sq.ft.

**Fertilizers listed are only examples of the types of fertilizers needed. Select a specialty turf fertilizer with a ratio similar to those listed.

Program 3 - Additional Comments:

1. If needed to improve color, 1 lb of actual nitrogen per 1000 sq.ft. from a quickly available source may be applied in late November or December.

2. If the soil is low in phosphate or potash, it may be desirable tc apply enough additional nutrient(s) to bring the total phosphate and potash applied for the year to 3 lbs. Fall application is preferred.

3. When using a complete fertilizer, make certain that the water insoluble nitrogen content is 50% or more of the total nitrogen. Otherwise, use Program 1.

VIRGINIA POLYTECHNIC INSTITUTE & STATE UNIVERSITY
EXTENSION DIVISION SOIL TESTING LABORATORY
MA-248 April, 1979

SOIL TEST NOTES
(Supplement to Soil Test Report)

NOTE 18. Maintaining Bermudagrass and Zoysiagrass Lawns

APPLYING LIME TO ESTABLISHED LAWNS

If less than 50 lbs. of lime per 1000 sq.ft. is recommended, apply full amount of lime in one application. If more than 50 lbs. of lime per 1000 sq.ft is recommended, apply the lime in several applications of up to 50 lbs. each, at intervals of 1 to 6 months, until the full amount is applied. Applying more than 50 lbs. per 1000 sq.ft. at any one time may result in an undesirable residue on the turf.

REPAIR OF BARE SPOTS

Prepare bare spots for seeding, sodding, plugging or sprigging by raking soil so that approximately one inch of loose soil is on the surface. Mixing of topsoil and/or organic matter into these spots will help prepare these areas for seeding or vegetative establishment.

Apply the same amount and type of fertilizer and lime recommended for maintaining your lawn. Rake the fertilizer and lime into the upper inch of loose soil.

After seeding, apply mulch to conserve moisture. Seeded areas and areas sodded, plugged, or sprigged should be watered immediately after seeding or planting. Watering should continue as long as necessary to obtain satisfactory germination and establishment.

FERTILIZER PROGRAMS FOR LAWN MAINTENANCE

The following programs give flexibility in deciding on the types of fertilizer to use to best meet your needs. Programs 1 and 2 utilize fertilizers which contain readily available nitrogen [i.e., less than 50% of the nitrogen is slowly available--listed as WIN (Water Insoluble Nitrogen) on the fertilizer bag]. Program 3 utilizes fertilizers which contain slowly available nitrogen [i.e., more than 50% of the nitrogen is slowly available (WIN)]. Also, Programs 1 and 3 supply the three major nutrients (nitrogen, phosphate, potash) on a continuous basis, while Program 2 supplies the three major nutrients one time per year with nitrogen-only being applied the remainder of the time.

If used properly, any of the three programs will result in quality turf. Choose the program best suited to your needs and the available fertilizer supply in your area.

SELECT AND FOLLOW ONE PROGRAM
FROM FOLLOWING PageS

PROGRAM 1

Fertilizers Containing Readily Available Nitrogen (0-50% WIN)

Type of Fertilizer: Complete (N, P2O5, K2O)

Time of Application	Amount, Type of Fertilizer to Apply, lbs per 1000 sq. ft.
If Overseeded	
October 1 to October 15	8-12 lbs of 12-4-8 OR 5-7 1/2 lbs of 20-10-10 OR 4-6 lbs of 25-4-7
If Not Overseeded	
	0-6 lbs of 0-25-25
March 1 to April 1	12 lbs of 12-4-8 OR 7 1/2 lbs of 20-10-10 OR 6 lbs of 25-4-7
May 1 to June 1	12 lbs of 12-4-8 OR 7 1/2 lbs of 20-10-10 OR 6 lbs of 25-4-7
July 1 to August 1	8-12 lbs of 12-4-8 OR 5-7 1/2 lbs of 20-10-10 OR 4-6 lbs of 25-4-7

Program 1 - Additional Comments:

1. The October application is designed to supply 0 to 1 1/2 lbs of N per 1000 sq.ft., the March-April and May-June applications supply 1 1/2 lbs of N, and the July-August application supplies 1 to 1 1/2 lbs of N.

2. Fertilizers listed are only examples of the types of fertilizers needed. Select a specialty turf fertilizer with a ratio similar to those listed.

3. Readily available sources of nitrogen may cause burning if applied at heavy rates, or are not watered-in thoroughly immediately following application.

4. The July application should not be applied on zoysiagrass and may be omitted on bermudagrass turf if growth and color are satisfactory.

5. Nitrogen should be omitted for the fall application on zoysiagrass and on bermudagrass if not overseeded. However, the phosphate and potash should be applied during the fall if these elements are not applied on a continuous basis, or if a soil test indicates that either element is "Low".

PROGRAM 2

Fertilizers Containing Readily Available Nitrogen (0-50% WIN)

Type of Fertilizer: Complete (N, P2O5, K2O) + N Only

Time of Application	Amount, Type of Fertilizer to Apply, lbs per 1000 sq. ft.
	If Overseeded
Oct. 1 to Oct. 15	10-15 lbs of 10-10-10 OR 10-15 lbs of 5-10-10
	If Not Overseeded
	0-6 lbs of 0-25-25
March 1 to April 1	15 lbs of 10-10-10 OR 15 lbs of 10-5-5
May 1 to June 1	4 1/2 lbs ammonium nitrate OR 7 1/2 lbs ammonium nitrate lime OR 9 lbs nitrate of soda OR 3 1/2 lbs urea
July 1 to August 1	3-4 1/2 lbs ammonium nitrate OR 5-7 1/2 lbs ammonium nitrate lime OR 6-9 lbs nitrate of soda OR 2 1/2 - 3 1/2 lbs urea

Program 2 - Additional Comments:

1. The October application is designed to supply 0 to 1 1/2 lbs of N per 1000 sq.ft., the March-April and May-June applications supply 1 1/2 lbs of N, and the July-August application supplies 1 to 1 1/2 lbs of N.

2. Readily available sources of nitrogen may cause burning if applied at heavy rates, or are not watered-in thoroughy immediately following application.

3. The July application should not be applied on zoysiagrass and may be omitted on bermudagrass turf if growth and color are satisfactory.

4. Nitrogen should be omitted for the fall application on zoysiagrass and on bermudagrass if not overseeded. However, the phosphate and potash should be applied during the fall if these elements are not applied on a continuous basis, or if a soil test indicates that either element is Low.

PROGRAM 3
Fertilizers Containing Slowly Available Nitrogen
(>50% WIN)
Type of Fertilizer: Complete (N, P2O5, K2O)

Time of Application	Amount, Type of Fertilizer to Apply, lbs per 1000 sq. ft.
If Overseeded	
September 1 to October 15 (or after overseeding)	25 lbs of 12-4-8 OR 15 lbs of 20-10-10 OR 8 lbs urea-formaldehyde PLUS 4 to 8 lbs 0-25-25 or equivalent
If Not Overseeded	
	4 to 8 lbs of 0-25-25 or equivalent
March 1 to April 15	33 lbs of 12-4-8 OR 20 lbs of 20-10-10 OR 10 lbs urea-formaldehyde PLUS 4 to 8 lbs 0-25-25 or equivalent

Program 3-Additional Comments:

1. The September-October application is designed to supply 0 to 3 lbs of nitrogen per 1000 sq.ft. The March-April application supplies 4 lbs of nitrogen per 1000 sq.ft.

2. Fertilizers listed are only examples of the types of fertilizers needed. Select a specialty turf fertilizer with a ratio similar to those listed.

3. If needed to improve color of overseeded grass, 1 lb of actual nitrogen per 1000 sq. ft. from a quickly available source may be applied in winter between November and February.

4. Phosphate and potash applications should not exceed 1-1/2 to 3 lbs per year depending on the level in the soil.

5. Unless overseeded, nitrogen should not be applied during fall.

ADDITIONAL INFORMATION

Additional information may be obtained from your local VPI&SU Cooperative Extension Office. Publications available at present are:

Publication 211. Turfgrass Guide
MA-169. Fertilizer Programs for Maintaining Bermudagrass and Zoysia.
MA-200. Lawn and Turf Establishment.

Prepared by:
J.R. Hall, III, Extension Specialist, Turf
J.F. Shoulders, Extension Specialist, Turf
S.J. Donohue, Extension Specialist, Soil and Plant Analysis

VIRGINIA POLYTECHNIC INSTITUTE & STATE UNIVERSITY
EXTENSION DIVISION SOIL TESTING LABORATORY
MA-249 April, 1979

SOIL TEST NOTES
(Supplement to Soil Test Report)

NOTE 19. Vegetable Gardens, Flower Gardens, Roses, Potted House Plants

VEGETABLE GARDENS

Fertilization

How to Apply - Broadcast the recommended amount of fertilizer before planting and disk, rototill, or spade 5 inches deep into soil.

Tomatoes, Green Peppers, Lima Beans - If the garden area has been liberally fertilized in the past and the soil tests High or Very High for phosphate and potash, for best results apply one-half the recommended amount of fertilizer before planting and the remaining half after fruit set. Too much fertilizer applied early in the spring for these vegetables will encourage vegetative growth and reduce fruit set.

Sidedressing - Corn and leafy vegetables such as broccoli, cabbage, celery, kale, lettuce, and spinach will respond to a sidedress application of fertiliizer applied between the rows about one month after planting. To sidedress, apply one pound of 10-10-10 or two pounds of 5-10-5 (or 5-10-10) per 100 feet of row and scratch into the top inch of soil with a rake.

Liming

Where Less Than 10 Pounds Per 100 Sq.Ft. is Recommended - Broadcast the recommended amount before planting and disk, rototill, or

spade 5 inches deep into soil.

Where More Than 10 Pounds Per 100 Sq.Ft. is Recommended - Disk, rototill, or spade one-half of limestone 5 inches deep into soil and work remainder into the top 2 inches of soil to insure good germination and seedling growth.

Organic Matter

Organic matter loosems and improves the structure of heavy clay soils. In medium and light sandy soils, organic matter helps to hold moisture and nutrients. Some sources of organic matter are peat moss, compost, plant residues, leaf mold, manure, and sawdust.

To apply organic material, mix it thoroughly into the soil or turn it under at the rate of 30 to 50 pounds per 100 sq.ft. If poultry manure is used, it should be applied at only one-half the above rate since it is usually highly concentrated. If sawdust is used, increase the recommended rate of fertilizer by 50% to prevent nitrogen deficiency since this material tends to reduce or tie-up the nitrogen available to plants.

FLOWER GARDENS, ROSES

Fertilization

Pre-Plant - Broadcast the recommended amount of fertilizer before planting and disk, rototill, or spade 5 inches deep into soil. Avoid excessive fertilizer application because this may cause succulent vegetative growth and few flowers.

For Established Plants - Spread fertilizer evenly around plants and, if possible, rake into the top inch of soil without disturbing the root system. Immediately wash off any fertilizer that comes into contact with foliage.

Additional Rose Fertilization - Roses require periodic fertilization throughout the growing season to promote new flower development. Repeat the basic fertilizer application each month from March through August.

Liming

1. Pre-Plant:

   a. Where Less Than 10 Pounds Per 100 Sq.Ft. is Recommended - Broadcast the reccmmended amount before planting and disk, rototill, or spade 5 inches deep into soil.

   b. Where More Than 10 Pounds Per 100 Sq.Ft. is Recommended - Disk, rototill, cr spade one-half of limestone 5 inches deep into soil and work remainder into the top 2 inches of soil to insure good germination and seedling growth.

2. For Established Plants:

   a. Where Less Than 5 Pounds Per 100 Sq.Ft. is Recommended - Spread lime evenly around plants and, if possible, rake into the top inch of soil without disturbing the root system. Wash off any lime that comes in contact with foliage.

   b. Where More Than 5 Pounds Per 100 Sq.Ft. is Recommended - Apply the lime in several applications of 5 pounds each at intervals of approximately 1 to 6 months until the full amount is applied. Spread evenly around plants and, if possible, rake into the top inch of soil without disturbing the root system. Wash off any lime that comes in contact with foliage.

POTTED HOUSE PLANTS

Potted house plants normally grow well with minimal care other than periodic watering and fertilization, provided thay have adequate light

for normal growth. Common problems in growth of houseplants are over-fertilization (causing excessive fertilizer salts to accumulate in the soil to toxic levels), over-watering, too little light, and heavy, compacted soil which results in poor drainage and root growth.

Books explaining the fertilization, water, and light requirements of various potted house plants are available commercially from retail stores or may be found in your local library. The following are instructions for peparing soil mixes, and for fertilizing and liming potted house plants.

Preparing Soil Mixes

A successful potting mixture should have the right texture - one that will hold moisture without becoming waterlogged, and will allow free drainage. It should be free from soil pests, weed seeds, and plant diseases. To have these conditions, a commercially prepared soil mixture may be best. If not available, equal parts of a good garden soil and peat moss make an excellent soil mixture for potted house plants. To the mix should be added limestone at 1 tablespoon per 6" pot, and a 5-10-5 fertilizer at 1 teaspoon per 6" pot or a 10-10-10 fertilizer at 1/2 teaspoon per 6" pot. Mix thoroughly into the soil-peat moss mix.

Fertilizing Potted House Plants

Important: Make sure soil is moist before fertilizing! Do not fertilize when soil is dry as this will result in root burn. Apply 1 teaspoon of 5-10-5 fertilizer (or 1/2 teaspoon of 10-10-10 fertilizer) per 6" pot and water thoroughly into soil. Do not allow fertilizer to come into direct contact with foliage. Repeat application every 2 months when plants are actively growing, normally during the period from March to November. If other commercial house plant fertilizers are to be used, follow directions on label. Dc not overfertilize, because this may damage plants.

Liming Potted House Plants

Most potted house plants grow well at a pH of 6.0 to 6.5. Apply the recommended amount of lime around the base of the plant and scratch into the upper 1/4 to 1/2" of soil if possible without disturbing the root system.

OTHER INFORMATION

Supplementary Nitrogen Information

1 Pound of Nitrogen is Supplied by Any One of the Following Nitrogen Fertilizers:

6.3 lbs. of nitrate of soda (16% N)
5.0 lbs. of sulfate of ammonia (20.5% N)
5.0 lbs. of ANL (20.5% N)
3.0 lbs. of ammonium nitrate (33.5% N)
2.2 lbs. of Urea (45% N)

Fertilizer Substitution Table

For Each 10 Lbs. of This Grade	You May Substitute					
	Lbs.	Analysis		Lbs.	Analysis	
5-10-5	= 6.3	of 8-16-8	or	5.0	of	10-20-10
	or 4.2	of 12-24-12				
5-10-10	= 8.3	of 6-12-12	or	6.3	of	8-16-16
	or 5.0	of 10-20-20				
10-10-10	= 8.3	of 12-12-12	or	7.7	of	13-13-13
	or 6.7	of 15-15-15	or	5.0	of	20-20-20
10-5-5	= 8.3	of 12-6-6	or	7.1	of	14-7-7
	or 6.3	of 16-8-8	or	5.0	of	20-10-10

ADDITIONAL INFORMATION

Additional information may be obtained from your local VPI&SU Cooperative Extension Office. Publications available at present are:

Publication 44. Vegetable Gardening in Virginia.
MA-56. Growing Annual Flowers.

Prepared by:
S.J. Donohue, Extension Specialist, Soil and Plant Analysis
P.L. Smeal, Extension Specialist, Floriculture and Nursery Production

VIRGINIA POLYTECHNIC INSTITUTE & STATE UNIVERSITY
EXTENSION DIVISION SOIL TESTING LABORATORY
MA-250 April, 1979

SOIL TEST NOTES
(Supplement to Soil Test Report)

NOTE 20. Home Shrubs and Trees.

SHRUBS

No fertilizer is recommended for healthy shrubs that have a good green color and a moderate rate of growth. They will usually recieve adequate nutrients from the soil and the fertilizer which is applied to the surrounding lawn. Excessive vigor, which is evident by lush green leaves and long shoot growth, is undesirable.

If shrubs are exhibiting poor growth, i.e., have light green leaves and short, thin twigs, apply fertilizer as follows for more attractive growth:

Tree Height, Feet	Amount of 5-10-5 tc Apply Pounds Per Shrub
0 - 3	1/4 (1/2 cup)
4 - 8	1/2 (1 cup)
8+	1 (2 cups)

Apply the fertilizer uniformly over the roct zone, starting about 6 inches from the base of the shrub and extending out about a foot beyond the ends of the branches. Scratch the fertilizer into the mulch or grass with a rake, then water thoroughly.

Apply the fertilizer in early spring about a month before the average date of the last frost. Do not fertilize shrubs which are making satisfactory growth.

If you are not sure whether your plants need fertilizer, wait until they are in a stage of active growth about a month or 6 weeks after the last spring frost. If shrub growth is poor, apply fertilizer at the appropriate rate mentioned above.

TREES

Fertilization is not recommended for healthy trees with good green color. Adequate nutrients are usually supplied by the soil and the fertilizer which is applied to the surrounding lawn.

If trees are exhibiting poor growth, apply 2 lbs. (1 quart) of a 5-10-5 fertilizer for each inch of trunk diameter measured 3 feet above the ground. Apply the fertilizer 1 month before the average date of the last frost in spring. Broadcast the fertilizer in a band around the tree, starting about 2 feet from the trunk and extending out several feet beyond the ends of the branches. Scatter the fertilizer evenly over this area, then apply water liberally to wash it into the ground.

ADDITIONAL INFORMATION

Additional information may be obtained from your local VPI&SU Cooperative Extension Office

Prepared by:
S.J. Donohue, Extension Specialist, Soil and Plant Analysis
P.L. Smeal, Extension Specialist, Floriculture and Nursery Production

VIRGINIA POLYTECHNIC INSTITUTE & STATE UNIVERSITY
EXTENSION DIVISION SOIL TESTING LABORATORY
MA-251 April, 1979

SOIL TEST NOTES
(Supplement to Soil Test Report)

NOTE 21. Home Fruit Trees

Your Soil Test Report provides information on the amount of lime required for optimum tree growth and also indicates whether a "Complete" or "Nitrogen-Only" fertilizer will be needed. The amount of fertilizer to apply is contained in this leaflet.

AT PLANTING

No fertilizer is recommended at the time of planting. Fertilization will cause excessive weed growth (weeds will compete with the young trees for water) and may also injure the tree if fertilizer is placed in the hole at planting.

ESTABLISHED TREES

1. Complete Fertilizer Recommended

   If the soil test report indicates that a Complete Fertilizer is needed, apply 1/2 lb. (1 cup) of 10-10-10 fertilizer per tree for each year of tree's age in March. For example, if a tree is 4 years old, 2 lbs. of 10-10-10 will be needed (4 years x 1/2 lb. of 10-10-10 per year = 2 lbs. of 10-10-10). Repeat fertilizer application in April. Do not apply more than 10 lbs. of 10-10-10 fertilizer per tree annually.

2. Nitrogen-Only Fertilizer Recommended

   If the soil test report indicates that a Nitrogen-Only Fertilizer is needed, apply 1/4 lb. (1/2 cup) of nitrate of soda per

tree for each year of tree's age in March. For example, if a tree is 4 years old, 1 lb. of nitrate of soda will be needed (4 years x 1/4 lb. of nitrate of soda per year = 1 lb. of nitrate of soda). Repeat fertilizer application in April. Do not apply more than 5 lbs. of nitrate of soda per tree annually.

METHOD OF FERTILIZER APPLICATION

Scatter fertilizer evenly under the tree, starting about 1' from the trunk and extending to just beyond the tips of the branches.

ADJUSTING FERTILIZER RATES FOR INDIVIDUAL TREE GROWTH

Annual terminal growth and general vigor of the individual tree should be used as a guide to determine whether any modification in fertlizer application rate will be needed. The average amount of terminal growth considered adequate for various fruit trees is found in the following table:

Fruit Species	Length of annual terminal growth considered adequate for normal growth, inches	
	Bearing Trees	Non-Bearing Trees
Apple, pear, quince, plum, sour cherry	8 - 10	15 - 20
Peach, nectarine, sweet cherry	10 - 15	20 - 30

If growth the previous year was excessive: Eliminate the April fertilizer application and make just one fertilizer application in March.

If growth the previous year was short: Make an additional fertilizer application in May for a total of 3 fertilizer applications (i.e., 1 each in March, April and May).

Note - Avoid over-application! Too much fertilizer will cause excessive foliage development, poor fruit growth, and make some fruit species more susceptible to disease.

ADDITIONAL INFORMATION

Additional information may be obtained from your local VPI&SU Cooperative Extension Office. Publications available at present are:

Publication 10. Tree Fruits in the Home Garden.

Prepared by:
S.J. Donohue, Extension Specialist, Soil and Plant Analysis
D.C. Coston, Extension Fruit Specialist

VIRGINIA POLYTECHNIC INSTITUTE & STATE UNIVERSITY
EXTENSION DIVISION SOIL TESTING LABORATORY
MA-252 April, 1979

SOIL TEST NOTES
(Supplement to Soil Test Report)

NOTE 22. Small Fruits For Home Use

Small fruits thrive best in a fertile, sandy loam soil high in organic matter, but they will give good returns on the average garden soil under adequate fertilization and good cultural practices.

Your soil test report provides information on the amount of lime (or sulfur) required for optimum plant growth and also indicates whether a "Complete" or "Nitrogen-only" fertilizer will be needed. Since the amount of fertilizer to apply depends on the small fruit to be grown and the age of the plant, separate recommendations are listed in this leaflet for each small fruit.

STRAWBERRIES

Before Planting

If soil test report indicates that a complete fertilizer is needed, broadcast 1.5 lb. of 10-10-10 fertilizer (3 cups) per 100 sq.ft. Rototill or spade fertilizer 5" deep into soil before planting.

If a complete fertilizer is not needed, nitrogen should be applied at the rate of 1 lb. of nitrate of soda (2 cups) per 100 sq. ft. to help establish the new planting.

Established Strawberry Patches - Spring

Silt loams, clays, clay loams - Spring fertilization is not recommended on these soils since there is a danger of excessive

growth which results in reduced yield and poorer quality fruit.

Sandy soils - Due to rapid nutrient leaching on these soils, Spring fertilizer applications are normally beneficial. If soil test report indicates that a complete fertilizer is needed, apply 2 lb. of 10-10-10 fertilizer (4 cups) per 100 feet of row directly over the row. Brush fertilizer off plants and, preferably, apply on a dry afternoon.

If a complete fertilizer is not needed, nitrogen should be applied at the rate of 1.5 lb. of nitrate of soda (3 cups) per 100 feet of row directly over the row. Brush fertilizer off plants and, if possible, apply fertilizer on a dry afternoon.

Established Strawberry Patches - Late Summer (after picking)

If soil test report indicates that a complete fertilizer is needed, apply 2 lb. of 10-10-10 fertilizer (4 cups) per 100 feet of row directly over the row. Brush fertilizer off plants and, preferably, apply on a dry afternoon.

If a complete fertilizer is not needed, nitrogen should be applied at the rate of 1.5 lb. of nitrate of soda (3 cups) per 100 feet of row directly over the row. Brush fertilizer off plants and, if possible, apply fertilizer on a dry afternoon.

GRAPES

First Year

Fertilizer is not recommended at the time of planting. However, fertilizer may be applied about one month after growth has begun. If the soil test report indicates that a complete fertilizer is needed, apply 4 oz. of 10-10-10 fertilizer (1/2 cup) in a circle around each vine about 12" from the trunk. If a complete fetilizer

is not needed, nitrogen should be applied at the rate of 2 oz. of nitrate of soda (1/4 cup) in a circle 12" from each vine. Repeat the fertilizer application about 6 weeks later.

Second Year

Apply fertilizer just before growth begins in the Spring. If the soil test report indicates that a complete fertilizer is needed, apply 8 oz. of 10-10-10 fertilizer (1 cup) in a circle around each vine about 12" from the trunk. If a complete fertilizer is not needed, nitrogen should be applied at the rate of 4 oz. of nitrate of soda (1/2 cup) in a circle 12" from each vine.

Third and Subsequent Years

Apply fertilizer just before growth begins in the Spring. If the soil test report indicates that a complete fertilizer is needed, apply 12 oz. of 10-10-10 fertilizer (1 1/2 cups) in a circle around each vine about 12" from the trunk. If a complete fertilizer is not needed, nitrogen should be applied at the rate of 8 oz. of nitrate of soda (1 cup) in a circle 12" from each vine.

If the average cane growth is only 3' or less, additional nitrogen may be needed. However, where proper pruning is practiced and competition from weeds and grass is kept to a minimum, it is doubtful that you will need to go beyond the amount recommended.

RASPBERRIES AND BLACKBERRIES

Apply fertilizer when growth begins in Spring. If the soil test report indicates that a complete fertilizer is needed, apply 3 lb. of 10-10-10 fertilizer (6 cups) per 100 feet of row. If a complete fertilizer is not needed, nitrogen should be applied at the rate of 2 lb. of nitrate of soda (4 cups) per 100 feet of row.

BLUEBERRIES

First Year

Fertilization of blueberries is not recommended at the time of planting. However, fertilizer may be applied about one month after growth has been initiated. If the soil test report indicates that a complete fertilizer is needed, apply 4 oz. (1/2 cup) of 10-10-10 fertilizer in a circle around each plant about 8" from its base. If a complete fertilizer is not needed, nitrogen should be applied at the rate of 2 oz. (1/4 cup) of ammonium sulfate in a circle 8" from each plant. Cottonseed meal, an organic fertilizer preferred by many home gardeners, may be used instead of ammonium sulfate at the rate of 8 oz. (1 cup) per plant.

Second and Subsequent Years

Fertilizer should be applied to established blueberry bushes just before the buds begins to swell each Spring. If the soil test report indicates that a complete fertilizer is needed, apply 2 oz. (1/4 cup) of 10-10-10 fertilizer for each year of growth up to a total of 16 oz. annually. (For example, if bushes are 4 years old, 8 oz. of 10-10-10 fertilizer will be needed). If a complete fertilizer is not needed, nitrogen should be applied at the rate of 1 oz. (1/8 cup) of ammonium sulfate for each year of growth up to a total of 8 oz. annually. If desired, cottonseed meal may be used in place of ammonium sulfate at the rate of 8 oz. (1 cup) per plant for non-bearing bushes and 1 lb. (2 cups) per plant for bearing bushes. Apply fertilizer in a circle around each plant approximately 8" from its base.

CURRANTS AND GOOSEBERRIES

Currants and gooseberries are alternate hosts to the white pine blister rust disease. Since they are instrumental in the spread of this disease, their planting is restricted in many areas of Virginia. Before planting either of these fruits,

contact your local VPI&SU Cooperative Extension Agent for regulations governing their production and shipment.

Apply fertilizer just before the buds begin to swell in the Spring. If the soil test report indicates that a complete fertilizer is needed, apply 1 lb. (2 cups) of 10-10-10 fertilizer in a circle around each plant about 8" from its base. If a complete fertilizer is not needed, nitrogen should be applied at the rate of 8 oz. (1 cup) of nitrate of soda in a circle 8" from each plant.

MULCHING

Many small fruits are mulched to conserve moisture, check weed growth and add organic matter to the soil. Nearly any organic material makes good mulch-- straw, hay, pine needles, leaves, crushed corncobs, peat moss, or sawdust. In general, mulches should be applied to a depth of about 4" around each plant except for sawdust where 2" is sufficient. In some instances where the mulch is mixed in with the soil, a temporary nitrogen deficiency may occur as the mulch begins to decay. Should this occur, it can be quickly overcome through the application of 8 oz. (1 cup) of nitrate of soda to each 100 sq. ft. of mulched area.

Black plastic may also be used as a mulch if desired. It serves to conserve moisture and check weed growth, but does not add to the humus content of the soil upon deterioration.

USE OF DIFFERENT FERTILIZER MATERIALS

If a recommended fertilizer is not available locally, one of the following fertilizers may be substituted:

Recommended Fertilizer	Substitute	Use Substitute at:
10-10-10	5-10- 5	double recommended rate
10-10-10	5-10-10	double recommended rate
10-10-10	10- 6- 4	same rate
nitrate of soda	ammonium nitrate	1/2 recommended rate
ammonium sulfate	nitrate of soda	same rate
ammonium sulfate	ammonium nitrate	1/2 recommended rate

If you desire to use a fertilizer that is not listed above, check first with your extension agent before using. Improper fertilizer use may burn foliage or cause excessive foliage growth and often does more harm than good.

ADDITIONAL INFORMATION

Additional information may be obtained from your local VPI&SU Cooperative Extension Office. Publications available at present are:

Publication 319. Small Fruits in the Home Garden.

Prepared by:
S.J. Donohue, Extension Specialist, Soil and Plant Analysis
C.R. O'Dell, Extension Specialist, Small Fruits and Vegetable Production

APPENDIX C

SOIL TEST FORMS

Ext. Form 124

Cooperative Extension Service
;inia Polytechnic Institute & State University
Soil Testing Laboratory

SOIL SAMPLE INFORMATION SHEET
FOR
COMMERCIAL CROP PRODUCTION

PLEASE PRINT

DATE_ _ _ _ _ _

INSTRUCTIONS: Follow sampling instructions on box. Fill out this sheet as completely as possible. Place check marks(✓) where appropriate. Use other forms for home lawns, gardens, etc. Send samples to: Extension Agronomist, Soil Testing Laboratory, Smyth Hall, VPI & SU, Blacksburg, Virginia 24061.

Grower's Name_ _
Street, Route_ _
City_ _ _ _ _ _ _ _ _ _ _ _ _ _ _ _ _ _Zip_ _ _ _ _County_ _ _ _ _ _ _ _ _ _ _ _ _ _

Extra Copy For: (Dealer, etc.)_ _
Street, Route_ _
City_ _ _ _ _ _ _ _ _ _ _ _ _ _ _ _ _ _Zip_ _

For Office Use Only
Unit Code:
CAM LRO RCH

SAMPLE IDENTIFICATION, ACREAGE

Lab No. (Leave blank)	Your SAMPLE NUMBER (Up to 5 digits)	ASC Farm No.	No. of Acres

RECOMMENDATIONS REQUESTED FOR

Crop to be Grown		Next Crop	
Code (see back)	Name	Code	Name
☐☐☐		☐☐☐	

PAST HISTORY OF SAMPLED AREA

Last Crop		Last Crop's Yield (100 bu/a, etc.)	Last Crop's Fertilizer Application, lb/a			Last Lime Application	
Code	Name		N	P_2O_5	K_2O	Months Previous	Rate, T/A
☐☐☐	_ _ _ _ _ _ _ _ _ _	_ _ _ _ _	☐☐☐	☐☐☐	☐☐☐	☐ --- ☐ 0- 6 ☐ 7-12 ☐ 13-18 ☐ 18+	☐ 0 ☐ 0.1-1.0 ☐ 1.1-2.0 ☐ 2.1-3.0 ☐ 3.0+

SOIL INFORMATION

Soil Type Sandy(S) Loamy(L) Clayey(C) Organic(O)	Soil Name	Slope Level(L) Slight(S) Moderate(M) Steep(St)	Soil Prod. Group (see back)
☐ S ☐ L ☐ C ☐ O	_ _ _ _ _ _ _ _ _ _ _ _ _	☐ L ☐ S ☐ M ☐ St	☐ I ☐ II ☐ III ☐ IV

OTHER INFORMATION

Will Manure Be Used?	ASC Cost-Share	Special Tests Needed? (see back)
☐ no ☐ yes	☐ no ☐ yes	_ _

NOTE any unusual conditions of soil or crops_ _

CROP CODES (Insert crop no. & name on front of form)

Field Crops
1. Corn(Grain), No Till
2. Corn(Grain), Conventional
3. Corn(Silage), No Till
4. Corn(Silage), Conventional
5. Grain Sorghum
6. Wheat
7. Barley
8. Oats
9. Rye(Grain or Silage Only)
10. Soybeans
11. Small Grain-Soybean Double Crop Rotation
12. Small Grain-Grain Sorghum Double Crop Rotation
13. Peanuts
14. Cotton
15. Tobacco, Flue-Cured
16. Tobacco, Dark-Fired
17. Tobacco, Sun-Cured
18. Tobacco, Burley

Forage Crops-Establishment
30. Alfalfa, Alfalfa-Grass
31. Red Clover-Grass
32. Tall Grass-Ladino Clover
33. Tall Grass(Orch'grass,Fescue,etc)
34. Bermudagrass
35. Sorghum-Sudan, Millet, Sudan
36. Small Grains With Winter Annual Legumes For Hay or Grazing

Forage Crops-Maintenance
37. Alfalfa, Alfalfa-Grass
38. Red Clover-Grass Hay
39. Tall Grass Pasture
40. Grass-Clover Pasture(0-25% Legume)
41. Grass-Clover Pasture(25%+ Legume)
42. Native Pasture(0-25% Legume)
43. Native Pasture(25%+ Legume)
44. Tall Grass-Hay
45. Stockpiled Tall Fescue
46. Bermudagrass-Pasture
47. Bermudagrass-Hay

Commercial Vegetable Crops
50. Asparagus-Nonhybrid Strains
51. Asparagus-New Hybrids
52. Beans, Lima
53. Beans, Snap
54. Broccoli, Cauliflower
55. Cabbage
56. Brussel Sprouts, Collards
57. Cucumbers
58. Muskmelons
59. Onions, Bulbs
60. Onions, Scallions
61. Peas
62. Peppers
63. Potatoes, White
64. Potatoes, Sweet
65. Pumpkins
66. Spinach
67. Squash
68. Strawberries
69. Sweet Corn-Fresh Market
70. Sweet Corn-Processing
71. Tomatoes-Fresh Market
72. Tomatoes-Proc., Multiple Harvests
73. Tomatoes-Proc., Machine Harvest
74. Watermelons

Commercial Turf Production
80. Putting Greens, Bentgrass
81. Putting Greens, Bermudagrass
82. Tees, Bentgrass
83. Tees, Bermudagrass
84. Fairways-Ky Bluegrass,Fescue
85. Fairways-Bermudagrass
86. Athletic Fields-Ky Bluegrass,Fescue
87. Athletic Fields-Bermudagrass
88. Industrial Lawns-Ky Bluegrass,Fescue
89. Industrial Lawns-Bermudagrass
90. Sod Production-Ky Bluegrass,Fescue
91. Sod Production-Bermudagrass,Zoysia

Commercial Forest Tree & Fruit Crops
95. Apples
96. Peaches
100. Christmas Trees
101. Fir, Spruce Establishment
102. Fir, Spruce Maintenance
103. Fir, Spruce Nursery
104. Fir, Spruce Seed Orchard
105. Hardwood Establishment
106. Hardwood Maintenance
107. Hardwood Nursery, Black Walnut
108. Hardwood Seed Orchard
109. Pine Establishment
110. Pine Maintenance
111. Pine Nursery
112. Pine Seed Orchard

Other Crops
199. Insert "199" and crop name on other side

pecial Tests - The Soil Testing Laboratory offers up to five additional special tests that are applicable under certain onditions or for certain areas of the state. For information on the special tests that may be needed for your area, contact our Extension agent.

sing Soil Productivity Groupings - The soils in Virginia have been carefully evaluated and placed into one of four categories according to their productive potential for the specific field or forage crop to be grown. Productivity Group I oils are considered most productive, Group II-above average, Group III-average, and Group IV-below average in yield.

To effectively use Soil Productivity Groupings for a customized fertilizer recommendation, your soil must be identified ccording to its name and slope phase and entered onto this form. When this is done, there is no need to check a specific oil Productivity Group on this form as the soil will automatically be placed into the proper productivity grouping by our omputer for calculating the recommendation. Information on the soils on your farm may be obtained from a SCS Farm Map, a ounty Soil Survey Report, or from your local Extension office.

n Absence of Soil Name - The chart below gives long-term average yield levels for the various Soil Productivity Groupings . n the absence of specific information on your soil name, you can mark the Soil Productivity Group on the front of this form orresponding to your expected yield level. However, use of soil name where possible will eliminate any guess work in electing the proper Productivity Group.

Soil Productivity Group*	Corn, Silage	Corn, Grain Gr. Sorghum†	Wheat	Barley	Oats	Soybeans	Alfalfa Hay	Tall Grass Hay Red Clover-Grass Hay	Tall-Grass-Clover Pasture	Native Pasture
	T/A	bu/A					T/A		A/Cow	
I	22+	135+	60+	80+	80+	35+	4.5+	4.0+	1.25	1.5
II	18-22	110-135	50-60	60-80	60-80	30-35	3.75-4.5	3.5 -4.0	1.25-1.75	1.5-2.0
III	14-18	90-110	40-50	50-60	40-60	25-30	3.0 -3.75	3.0 -3.5	>1.75	2.0-2.5
IV	10-14	<90	30-40	35-50	30-40	18-25	2.25-3.0	2.25-3.0	--	2.5-3.0

rops not listed have, in general, a high cash value and require abundant fertilization to insure maximum yields. In these instances, Soil Productivity Groups are not used.
or small grain-soybean or small grain-grain sorghum double crop rotations, use the yield levels listed under the small grain category to determine the Soil Productivity Group.

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Ext. Form 125
Cooperative Extension Service
Virginia Polytechnic Institute & State University
Soil Testing Laboratory

SOIL SAMPLE INFORMATION SHEET
FOR
HOME LAWNS, GARDENS, FRUITS, AND ORNAMENTALS

PLEASE PRINT

DATE_____

INSTRUCTIONS: See other side for sampling instructions. Fill out this form as completely as possible. Place check marks(✓)where appropriate. Be sure to fill in both plant name and code number. Use other forms for commercial crop production. Send samples to: Soil Testing Lab, Smyth Hall, VPI & SU, Blacksburg, Virginia 24061.

Homeowner's Name_____

Street, Route_____

City_____ Zip_____ County_____

Extra Copy For: (Landscaper, etc.)_____

Street, Route_____

City_____ Zip_____

For Office Use Only.
Unit Code:
CAM
LRO
RCH

SAMPLE IDENTIFICATION

Lab No. (Leave blank)	Your SAMPLE NUMBER (Up to 5 digits)
	☐☐☐☐☐

CROP OR PLANT INFORMATION

Plant to be Grown	
Code (see back)	Name
☐☐☐	

PAST HISTORY OF SAMPLED AREA

Last Fertilizer Application			Last Lime Application		
Fertilizer Used	Amount Applied: Pounds per 100 Sq.Ft.	Amount Applied: Pounds per 1000 Sq.Ft.	Months Previous	Amount Applied: Pounds per 100 Sq.Ft.	Amount Applied: Pounds per 1000 Sq.Ft.
☐ None	☐ 0	☐ 0	☐ ---	☐ 0	☐ 0
☐ 5-10-5	☐ 0.1-1.0	☐ 1-10	☐ 0- 6	☐ 1-5	☐ 10-50
☐ 10-10-10	☐ 1.1-2.0	☐ 11-20	☐ 7-12	☐ 6-10	☐ 51-100
☐ Turf Type	☐ 2.1-4.0	☐ 21-40	☐ 13-18	☐ 11-15	☐ 101-150
☐ Other	☐ 4.0+	☐ 40+	☐ 18+	☐ 15+	☐ 150+

OTHER INFORMATION

Soil Type: Sandy(S) Loamy(L) Clayey(C)	Special Tests (Agent use only)	NOTE Any Unusual Conditions of Soil or Crops
☐ S ☐ L ☐ C	_____ _____	_____ _____

CROP CODES
(Insert code no. & crop name on front side)

Lawn - Kentucky Bluegrass or Fescue
201. Establishing New Lawn
202. Maintaining Lawn, Repair of Bare Spots

Lawn - Bermudagrass or Zoysiagrass
203. Establishing New Lawn
204. Maintaining Lawn, Repair of Bare Spots

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

Fruits
220. Apples
221. Blackberries
222. Blueberries
223. Currants
224. Gooseberries
225. Grapes
226. Nectarines
227. Peaches
228. Pears
229. Plums
230. Quince
231. Raspberries
232. Sour Cherry
233. Strawberries
234. Sweet Cherry

Shrubs & Trees
240. Azaleas
241. Andromedas
242. Camellias
243. Laurel
244. Rhododendron
245. Other Shrubs
246. Trees

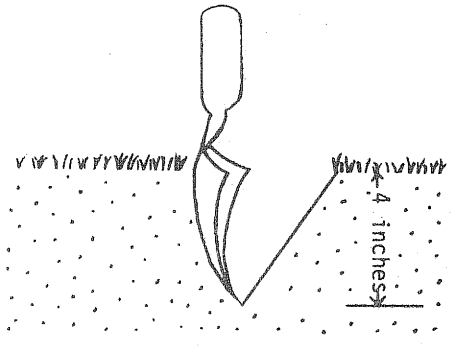
Other Plant Species
250. Potted House Plants
299. Other (Insert "299" and plant name on other side)

Important:
For test results to be meaningful, extreme care must be used when soil samples are taken. Each sample represents many tons of soil in your lawn or garden. Test results cannot be any more accurate than the sample submitted to the laboratory. Do not take samples when the soil is extremely wet.

Sampling Instructions:
Divide your lawn or garden into sampling areas. Each area should be uniform in the kind of soil and in the past fertilizer and lime treatment it has received. An example would be separate samples (areas) for front and back lawns. For shrubs and trees, select an area from the trunk to the outer edges of the branches. Take a separate sample from each area as shown in the diagram below. The following procedure should be followed for each sampling area:

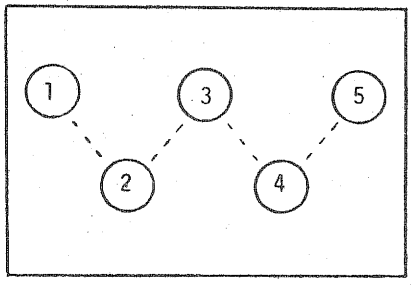
A - Take samples with a trowel, shovel, spade, or auger. Make a vertical cut 4" deep for lawns, or to plowing depth for gardens, and push the soil aside. Then cut a thin slice from the side of the opening that is of uniform thickness, approximately 2" in width, and extending from the top of the ground to the depth of the cut. Scrape away or discard any surface mat of grass or litter and place the slice of soil into a clean bucket or other container. This sampling procedure should be followed in 10 or more different locations within each sampling area, each time placing the resulting soil in the same container, giving you a composite sample.

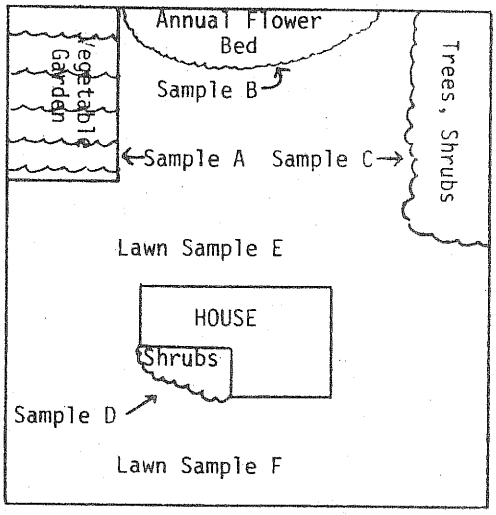
B - Thoroughly mix the soil from the composite sample and then fill the sample box to the top from the mixture. Fill in the information requested on the side of the sample box, including sample number, complete the other side of this sheet, and send sample and sheet to the Soil Testing Laboratory.



Sampling With Trowel, Shovel or Spade

How To Take Composite Samples of Each Bed or Section





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Ext. Form 126
Cooperative Extension Service
Virginia Polytechnic Institute & State University
Soil Testing Laboratory

SOIL SAMPLE INFORMATION SHEET
FOR
COMMERCIAL GREENHOUSE AND NURSERY PRODUCTION

PLEASE PRINT

DATE_____

INSTRUCTIONS: See other side for sampling instructions. Fill out this sheet as completely as possible. Place check marks(✓) where appropriate. Be sure to fill in both crop to be grown and code number. Use other forms for home lawns, gardens, and commercial field crop production. Send samples to: Soil Testing Laboratory, Smyth Hall, VPI & SU, Blacksburg, Virginia 24061.

Grower's Name_____

Street, Route_____

City_____ Zip_____ County_____

Extra Copy For:_____

Street,Route_____

City_____ Zip_____

For Office Use Only
Unit Code:
CAM
LRO
RCH

SAMPLE IDENTIFICATION

Lab No. (Leave blank)	Your SAMPLE NUMBER (Up to 5 digits)
	☐☐☐☐☐

CROP OR PLANT INFORMATION

Plant to be Grown	
Code (see back)	Name
☐☐☐	

OTHER INFORMATION

Last Lime Application (For field-grown nursery stock only)		Soil Information			Special Tests Needed?
Months Previous	Rate, T/A	Field Soils: Sandy(S) Loamy(L) Clayey(C) Organic(O)	OR	Bench, Pot Soils: 1:1 Soil-Light-weight Mix(1:1) Soilless Mix(S)	
☐---	☐0	☐S		☐1:1	_____
☐0- 6	☐0.1-1.0	☐L			_____
☐7-12	☐1.1-2.0	☐C		☐S	_____
☐13-18	☐2.1-3.0	☐O			_____
☐18+	☐3.0+				_____

NOTE Any Unusual Conditions of Soil or Crops_____

_____

CROP CODES

(Insert code no. & crop name on front side of form)

GREENHOUSE PRODUCTION

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

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

Other Plants
- 320. Bedding Plants
- 321. Foliage Plants
- 322. Hanging Baskets
- 323. Vegetable Transplants
- 399. Other (Insert "399" & crop name on other side)

NURSERY PRODUCTION

- 351. Field Grown--Acid-Loving Plants
- 352. Field Grown--Non Acid-Loving Plants
- 353. Container Grown--Acid-Loving Plants
- 354. Container Grown--Non Acid-Loving Plants
- 399. Other (Insert "399" & crop name on other side)

SAMPLING INSTRUCTIONS - BENCH, POT SOILS

Important:

For test results to be meaningful, extreme care must be used when samples are taken. Test results cannot be any more accurate than the sample submitted to the laboratory. Sample before watering benches or pots. Do not sample when the soil is extremely wet.

Sampling Benches:

Using a clean trowel or sampling tube, take 8 to 10 cores of soil per 100 foot bench in a random fashion. The mulch and top ¼" of soil should be scraped away. Sample to the full depth of the soil in the bench. Thoroughly mix all cores from one bench to make one composite sample.

Sampling Ground Beds, Soil Bins, Potted Plants:

Sample ground beds in the same manner as bench soils to a depth of 6-7". For soil bins, take 8 to 10 cores per bin for the composite sample. For potted plants, remove one core of soil from 8 to 10 pots and mix to make one composite sample.

Preparing the Sample for Shipping:

After thoroughly mixing the composite sample, fill the sample box to the top from the mixture. Fill in the information requested on the side of the sample box, including sample number, complete the other side of this sheet, and send sample and sheet to the Soil Testing Laboratory.

SAMPLING INSTRUCTIONS - FIELD SOILS

See instructions on side of soil sample box.

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Ext. Form 127

Cooperative Extension Service

Virginia Polytechnic Institute & State University

Soil Testing Laboratory

SOIL SAMPLE INFORMATION SHEET
FOR
SURFACE MINED AREAS

PLEASE PRINT

Date_____

INSTRUCTIONS: Follow sampling instructions on box. Fill out this sheet as completely as possible. Place check marks (✓) where appropriate. Use other forms for non-surface mined areas. Send samples to: Extension Agronomist, Soil Testing Laboratory, Smyth Hall, VPI & SU, Blacksburg, Virginia 24061.

Grower's Name_____

Street, Route_____

City_____ Zip_____ County_____

Extra Copy For: (Dealer, etc.)_____

Street, Route_____

City_____ Zip_____

For Office Use Only
Unit Code:
CAM
LRO
RCH

SAMPLE IDENTIFICATION, ACREAGE

Lab No. (Leave blank)	Your SAMPLE NUMBER (Up to 5 digits)	Permit No.	No. of Acres

RECOMMENDATIONS REQUESTED FOR

Crop to be Grown		Next Crop	
Code (see back)	Name	Code	Name
☐☐☐		☐☐☐	

PAST HISTORY OF SAMPLED AREA

Last Crop		Last Crop's Yield (100 bu/a, etc.)	Last Crop's Fertilizer Application, lb/a			Last Lime Application	
Code	Name		N	P_2O_5	K_2O	Months Previous	Rate, T/A
☐☐☐	_____	_____	☐☐☐	☐☐☐	☐☐☐	☐ --- ☐ 0- 6 ☐ 7-12 ☐ 13-18 ☐ 18+	☐ 0 ☐ 0.1-1.0 ☐ 1.1-2.0 ☐ 2.1-3.0 ☐ 3.0+

SOIL INFORMATION

Soil Type Sandy (S) Loamy (L) Clayey (C)	Soil Name	Slope Level (L) Slight (S) Moderate (M) Steep (St)
☐ S ☐ L ☐ C	_____	☐ L ☐ S ☐ M ☐ St

OTHER INFORMATION

Will Manure Be Used?	Special Tests Needed? (see back)
☐ no ☐ yes	_____ _____ _____ _____

NOTE any unusual conditions of soil or crops_____

_____

CROP CODES(Insert crop no. & name on front of form)

Instructions: Select the appropriate crop(s) from the following list and insert code number & crop name on the front side of the form. (For information on grass & legume establishment mixtures, refer to Reclamation Manual.)

Field Crops
401. Corn(Grain), No Till
402. Corn(Grain), Conventional
403. Corn(Silage), No Till
404. Corn(Silage), Conventional
406. Wheat
407. Barley
408. Oats
409. Rye
410. Soybeans
411. Small Grain-Soybean Double Crop Rotation
412. Small Grain-Grain Sorghum Double Crop Rotation

Grasses & Legumes-Establishment(Seeding)
420. Erosion Control Mixtures
421. Hay & Pasture Mixtures
422. Critical Area Mixtures
423. Temporary Cover Mixtures

Forage Production-Maintenance
437. Alfalfa, Alfalfa-Grass
438. Red Clover-Grass Hay
439. Tall Grass Pasture
440. Grass-Clover Pasture(0-25% Legume)
441. Grass-Clover Pasture(25%+ Legume)
444. Tall Grass-Hay
445. Stockpiled Tall Fescue

Commercial Vegetable Crops
457. Cucumbers
458. Muskmelons
462. Peppers
463. Potatoes, White
464. Potatoes, Sweet
465. Pumpkins
467. Squash
468. Strawberries
469. Sweet Corn-Fresh Market
471. Tomatoes-Fresh Market

Other Crops
488. Industrial Lawns
495. Apples
496. Peaches

For Crops Not Listed
499. Insert "499" & crop name on other side

Special Tests - The Soil Testing Laboratory offers up to five additional special test that are applicable under certain conditions or for certain areas of the state. For information on the special tests that may be needed for your area, contact your extension agent.

Collecting Spoil Samples - Spoil samples, improperly taken, often are misleading and can lead to poor germination, seedling growth, and vegetative cover. A sample weighs about one-half pound. A careful job of collecting samples must be done in order for such a small sample to adequately represent several acres of spoil. To obtain a representative sample, it is necessary to collect (in a clean plastic bucket) 15 to 20 subsamples of about the same quantity. Depth of sampling should be 4 to 6 inches. A small pick and/or mattox is the best tool for collecting spoil samples. The area represented by one sample should not be more than about 5 acres, depending upon uniformity of the spoil. In sampling spoil, collect subsamples that are more or less uniform in color, rock material, and amount of soil. If you think a certain area will be difficult to revegetate, sample it separately from those adjacent to it. Spoil slopes should be sampled separately from bench areas.

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COOPERATIVE EXTENSION SERVICE

VIRGINIA POLYTECHNIC INSTITUTE AND STATE UNIVERSITY

SOIL TEST REPORT

NOTES:

OWNER

COPY OF

HISTORY OF SAMPLED AREA

SAMPLE No.	LAB ID No.	ASC FARM No.	No. OF ACRES	SOIL TYPE	SLOPE	SOIL PROD GROUP	LAST CROP		LAST CROPS FERTILIZATION, lb/A			LAST LIME APPLICATION	
							NAME	YIELD	N	P_2O_5	K_2O	MO. PREV.	T/A

LAB TEST RESULTS

SOIL pH	P lb/A	K lb/A	Ca lb/A	Mg lb/A		OM %	SS ppm	NO_3-N ppm	Zn ppm	Mn ppm

FERTILIZER AND LIMESTONE RECOMMENDATIONS

EXPLANATION OF SYMBOLS, ABBREVIATIONS

lb/A - Pounds per acre
T/A - Tons per acre
N - Nitrogen
P - Phosphorus
P_2O_5 - Phosphate
K^2O_5 - Potassium
K_2O - Potash

Ca - Calcium
Mg - Magnesium
OM - Organic Matter
SS - Soluble Salts
NO_3-N - Nitrate Nitrogen
Zn - Zinc
Mn - Manganese

SOIL TEST RATINGS

The soil test ratings indicate the relative availability of nutrients to the plant and are interpreted as follows: L = Low, M = Medium, H = High, VH = Very High, EH = Excessively High (Soluble Salt test only), DEF = Deficient, SUFF = Sufficient. Plants almost always respond to fertilizer for soils testing Low, sometimes for soils testing Medium, and do not usually respond for soils testing High or Very High.

FERTILIZER RECOMMENDATIONS

Fertilizer recommendations for commercial field and forage crops have been made for the next two crops in the rotation where two crops were specified. If yields for the first crop are considerably above or below average, it is advisable to re-test the soil before the second crop to determine any significant changes in the soil's fertility status.

For other crops, except where noted, the fertilizer recommendations may be used for the same crop for two to three years. After this time, it is advisable to re-test the soil to determine if significant changes have occurred in nutrient levels. It should be noted that, due to the variability associated with sampling, fertilizer application rates may be varied plus or minus 10%.

LIME RECOMMENDATIONS

The lime recommendations are for a single application which will last from two to three years. After this period of time, the soil should be re-tested. Do not overlime! Too much can be as harmful as too little. For best results, lime should be applied, where possible, several months ahead of the crop to be planted to allow time for more complete soil reaction.

SOIL TESTING FOR ESSENTIAL ELEMENTS

Extensive research has been and continues to be conducted for those essential plant elements for which soil tests are not presently offered. It is the philosophy of the VPI&SU Soil Testing Program to offer a soil test if 1) deficiencies have been observed on crops in Virginia and 2) suitable soil test methods have been developed, under Virginia conditions, to reliably predict crop response to a given nutrient. In instances where deficiencies, or soil test methods compatible with Virginia soils, have not been found, the soil testing program will not offer tests for these elements. The tests presently offered by the laboratory (and the general recommendations made for certain trace elements in cases where good soil test methods have not been found) are based on the most current findings in soil-nutrient relationships and crop nutrient needs in Virginia.

CONVERSION FACTORS (Some Values Are Approximate)

1 acre = 43,560 square feet
1 ppm = 1 part per million
1 pound of 5-10-5, 5-10-10 or 10-10-10 fertilizer = 2 cups
1 pound of ground limestone or ground dolomitic limestone = 1.5 cups
1 pound of aluminum sulfate or magnesium sulfate = 2.5 cups
1 pound of sulfur = 3.3 cups
1 quart = 2 pints = 4 cups
1 pint = 2 cups = 32 tablespoons
1 tablespoon = 3 teaspoons
1 bushel = 1.25 cubic feet
100 square feet = 5 feet x 20 feet, 10 feet x 10 feet, 2 feet x 50 feet
1000 square feet = 50 feet x 20 feet, 10 feet x 100 feet, 25 feet x 40 feet
Pounds per 100 square feet x 436 = pounds per acre
Pounds per 1000 square feet x 43.6 = pounds per acre
Pounds per acre x 0.0023 = pounds per 100 square feet
Pounds per acre x 0.023 = pounds per 1000 square feet