Model STH Series

Combination Soil Outfit

Instruction Manual

LaMotte

■ INTRODUCTION

This instruction manual is designed for use with the LaMotte STH professional soil testing outfit. This manual also includes special instructions for testing nitrate, phosphorus, and potassium in green plant tissues.

*WARNING: Reagents marked with an * are considered to be potential health hazards. To view or print a Safety Data Sheet (SDS) for these reagents go to www.lamotte.com. Search for the four digit reagent code number listed on the reagent label, in the contents list or in the test procedures. Omit any letter that follows or precedes the four digit code number. For example, if the code is 4450WT-H, search 4450. To obtain a printed copy, contact LaMotte by email, phone or fax.

Emergency information for all LaMotte reagents is available from Chem-Tel (US, 1-800-255-3924) (International, call collect, 813-248-0585).

Note: Some reagents in this kit are dispensed with screw-cap pipets that are packaged separately.

Place the screw-cap glass pipets (0341) on the following reagents:

5156	*Phosphorus Reagent #2
5101	*Aluminum Test Solution
5140	*Magnesium Test Solution #1

Place the screw-cap plastic pipets (0392) on the following reagents:

5146	*Nitrate Reagent #1
5108PS	*Calcium Test Solution
5171	*Sulfate Test Solution
5116PS	*Ferric Iron Test Solution
5103PS	*Ammonia Nitrogen Test Solution

■ MULTIPLE SAMPLE TESTING

When extracts from two or more samples are being tested simultaneously use separate pipets for each extract. Mixing samples will cause false test results. Multiple test tubes, pipets, and spot plates have been provided to facilitate proper analytical technique.

■ TEST METHODS

Color chart methods are used for all tests except for Potassium. The reaction is performed in a tube or on a spot plate and the resulting color is compared to a laminated color chart.

The Potassium test measures the amount of turbidity in a sample relative to the potassium content.

■ AVAILABLE NUTRIENTS

All tests measure the portion of the nutrient in the soil that would be "available" for the plant to use. Since extraction is not complete, the amount that is measured is relative, dependent on the extraction procedure.

■ SOIL SAMPLING & PREPARATION

Carefully follow the soil sampling procedures discussed in detail in the *LaMotte Soil Handbook* (1504). For sampling greenhouse soils, the following specialized procedure is recommended.

Collect greenhouse samples prior to watering. Remove any mulch covering the soil, and then use a soil sampling tube or spoon to take a sample from the entire plant rooting space, top to bottom. A composite sample insures representative test results. Thoroughly mix 8 to 10 individual samples, and then spread the composite sample on a sheet of paper or plastic to dry. Allow the sample to air dry overnight. Do not oven dry the sample. Sift the dried sample through a wire screen mesh similar to a window screen.

■ TEST PROCEDURES

pH

pH is a measure of acidity or basicity. Soils can have a pH from 3.5 to 11.0, but plants grow well in the range of 5.0 to 8.5. In soils with a low pH (acidic), some nutrients can reach toxic levels and the activity of soil microbes is greatly reduced. Soils with a high pH (alkaline) generally have a lower micro-nutrient availability and some levels may be deficient.

PROCEDURE

1. Fill a test tube (0204) approximately one-third full of soil. Use the Demineralizer Bottle (1155) to add demineralized water to the tube, until it is filled to one-half inch from the top. Cap and shake until the soil is well dispersed.
2. Add 5 drops of Soil Flocculating Reagent (5643WT). Cap and shake to mix. Allow contents to settle before proceeding to Step 3.
3. Use a 1 mL pipet (0354) to transfer 1 mL of the clear solution above the soil to one of the large depressions on a spot plate (0159). Transfer a second 1 mL sample to the other large depression on the spot plate.
4. To the first sample on the spot plate, add two drops of *Duplex Indicator (2221). Compare the resulting color reaction against the Duplex Color Chart (1313).
5. The wide range pH test result indicates which narrow range indicator and color chart should be selected to perform a more precise pH test. Choose the narrow range indicator and appropriate chart with a mid-point that is as close as possible to the value obtained in the wide range test.

Indicator	pH Range	Indicator Code	Color Chart Code
Bromcresol Green	3.8-5.4	2207	1328
Chlorphenol Red	5.2-6.8	2209	1329
Bromthymol Blue	6.0-7.6	2210	1331
Phenol Red	6.8-8.4	2211	1332
Thymol Blue	8.0-9.6	2213	1335

Example: If the wide range test result is pH 6.0, choose the Chlorphenol Red Indicator (2209) & the Chlorphenol Red Color Chart (1329) for Step 5.

6. Add two drops of the chosen narrow range indicator to the second sample on the spot plate. Compare the resulting color reaction against the appropriate color chart to obtain a precise soil pH reading.

Interpretation of pH Reading:

If the pH is:	**Then the soil is:**
Below 5.5	Strongly Acid
5.5-6.0	Moderately Acid
6.1-7.0	Slightly Acid
Above 7.0	Alkaline

Extraction

The following extraction procedure uses Universal Extracting Solution (5173PS) to produce a single soil extract which is used in each of the following tests: nitrate nitrogen, ammonia nitrogen, nitrite nitrogen, phosphorus, potassium, calcium, magnesium, sulfate, aluminum, iron, and manganese. The pH, chloride, humus, and plant tissue tests use extraction procedures described in the individual instructions for those tests.

The Extraction Tubes (0704) are marked at 7 and 14 mL. The instructions below assume that a number of tests will be performed with the general soil extract. Therefore 14 mL of extracting solution and eight level measures of the soil sample are called for in Steps 1 & 2. If only a single test is to be performed (e.g., nitrate nitrogen), fill the extraction tube to the 7 mL line (Step 1) and add only four level measures of the soil sample (Step 2).

PROCEDURE

1. Fill an Extraction Tube (0704) to the 14 mL line with Universal Extracting Solution (5173PS).
2. Use the 0.5 g spoon (0698) to add eight level measures of the soil sample. Cap and shake for one minute.

   Note: When adding samples with high concentrations of carbonates to the Universal Extracting Solution (5173), swirl tube to mix for 30 seconds before capping to allow gases to escape.
3. Use a piece of filter paper (0465) and a plastic funnel (0459) to filter the soil suspension into a second extraction tube (0704). (Fold the filter paper in half and then in half again to form a cone which is fitted into the funnel.) The filtrate in the second extraction tube is the general soil extract for use in the 11 individual test procedures listed previously.

Nitrate Nitrogen

The role of nitrogen in plant nutrition is discussed in the *LaMotte Soil Handbook*. For interpretation of test results see the *LaMotte Soil Handbook*.

PROCEDURE

1. Use a 1 mL pipet (0354) to transfer 1 mL of the general soil extract to one of the larger depressions on a spot plate (0159).
2. Add 10 drops of *Nitrate Reagent #1 (5146).
3. Use a 0.5 g spoon (0698) to add one level measure of *Nitrate Reagent 2 Powder (5147).
4. Stir thoroughly with a clean stirring rod (0519). Allow to stand five minutes for full color development.
5. Match sample color with the Nitrate Nitrogen Color Chart (1315). Record as pounds per acre nitrate nitrogen.

Potassium (Potash)

The role of potassium (potash) in plant nutrition is discussed in the *LaMotte Soil Handbook*. For interpretation of test results, see the *LaMotte Soil Handbook*.

When present in large amounts, ammonia salts will produce a precipitate similar to that produced by potassium. If fertilizer containing ammonia salts has recently been applied, or if the soil pH is below pH 5.0, perform the Ammonia Nitrogen test (page 19) before performing the potassium test. A high ammonia nitrogen test result will alert the operator to a probable false high reading in the potassium test; actual potassium levels will be somewhat lower.

It is important that the temperature of the test sample and the *Potassium Reagent C (5162) be in the range of 20-27°C (68-80°F). On warm days, prior to Step 3 below, cool both the test sample in the Potash "A" Tube and the Reagent C container by placing them in cool water.

PROCEDURE

1. Use a transfer pipet (0364) to fill a Potash "A" Tube (0245) to the lower line with the general soil extract.
2. Add one *Potassium B Tablet (5161A). Cap and shake until dissolved.

3. Add *Potassium Reagent C (5162) until the Potash “A” Tube is filled to the upper line. Allow the *Potassium Reagent C (5162) to run slowly down the side of the tube. Swirl the tube to mix. A precipitate will form if potassium is present.
4. Stand the empty Potash “B” Tube (0246) on the Potassium Reading Plate (1107), a rectangular piece of white plexiglass with a solid black line down the middle. Place the tube directly over the black line.
5. Fill a transfer pipet (0364) with the test sample from the Potash “A” Tube.
6. Slowly add the test sample to the Potash “B” Tube, allowing it to run down the side of the tube. Observe the black line down through the Potash “B” Tube. Continue to add the test sample until the black line just disappears.
7. Record the value where the level of the liquid meets the scale printed on the side of the Potash “B” Tube, as pounds per acre Available Potassium.
8. If the test result is equal to or greater than 400 pounds per acre, repeat the test on a diluted test sample as follows:

    A. Fill a Potash “C” Tube (0247) to the lower mark with the general soil extract.

    B. Add Universal Extracting Solution (5173) to the upper mark and mix.

    C. Using this diluted extract follow Steps 1 through 7 above. Multiply the test result by 2 to obtain pounds per acre Available Potassium.

Phosphorus

The role of phosphorus in plant nutrition is discussed in the *LaMotte Soil Handbook*. For interpretation of test results see the *LaMotte Soil Handbook*.

The Phosphorus test is extremely sensitive. Special precautions should be taken to prevent contamination. In particular, exposure of the test components to fertilizer dust must be scrupulously avoided. The operator's hands and clothing, the work surface, and the testing area in general must be clean and free of fertilizer residues.

LaMotte offers the Model NF Test Kit (Code 5090) for Phosphorus in Alkaline Soils, to be used in place of the test described below when the soils are predominantly alkaline (above pH 7.0).

PROCEDURE

1. Use a transfer pipet (0364) to fill a "Phosphorus B" Tube (0244) to the line with the general soil extract.
2. Add 6 drops of *Phosphorus Reagent 2 (5156). Cap and shake to mix.
3. Add one Phosphorus Test Tablet (5706A). Cap and shake until dissolved.
4. Immediately compare the color that develops in the test tube against the Phosphorus Color Chart (1312). Hold the tube about one inch in front of the white surface in the center of the color chart. View the chart and sample under natural light for optimum color comparison. The test result is read in pounds per acre Available Phosphorus.

Humus

Humus consists of the complex remains of fresh plant and animal residue after extensive chemical and biological breakdown. Humus accounts for 60% to 70% of the total organic carbon in soils. It can modify the physical properties of a soil, strongly affecting its chemical and biological properties.

PROCEDURE

1. Use the 0.5 g spoon (0698) to add eight level measures of soil to a soil extraction tube (0704).
2. Use the Demineralizer Bottle (1155) to fill the tube to the 14 mL line with demineralized water. Cap and shake to mix.
3. Use a 0.5 g spoon (0698) to add two level measures of *Humus Screening Reagent Powder (5119). If necessary, add more demineralized water to return the level of the liquid to the 14 mL line. Cap and shake vigorously for one minute.
4. Add 15 drops of Soil Flocculating Reagent (5643). Cap and mix gently. Allow to settle for several minutes.
5. Use a piece of filter paper (0465) and a plastic funnel (0459) to filter the mixture into a second extraction tube. (Fold filter paper in half and then in half again to form a cone which is fitted into the funnel.)
6. Compare the clear filtrate in the second extraction tube with the Humus Color Chart (1384).

Interpretation

The Humus color comparator is labeled with values of 1, 2, 3, 4, and 5. The results are interpreted as follows:

Humus or Organic Matter in Soil

Humus Reading	1	2	3	4	5
Agricultural Soils	Low	Medium	High		
Garden Greenhouse Soils		Low	Medium	High	
Organic Soils			Low	Medium	High

Magnesium

Magnesium is a constituent of chlorophyll, and chlorosis can result from magnesium deficiency. Like calcium, magnesium cations play a role in base or cation exchange. Magnesium is subject to more leaching than calcium. Soils giving a low test reading should receive dolomitic lime or fertilizer which contain considerable magnesia. Soils giving high magnesium tests and low calcium tests should receive gypsum or high calcic lime, in order to restore the calcium-magnesium balance.

PROCEDURE

1. Use a transfer pipet (0364) to transfer ten drops of the general soil extract to one of the larger depressions on a spot plate (0159).
2. Add one drop of *Magnesium Test Solution 1 (5140). Stir with a clean rod (0519). A pale yellow color will develop.
3. Add *Magnesium and Manganese Test Solution 2 (5145WT) one drop at a time with stirring, until the pale yellow color changes to one of the darker shades indicated on the Magnesium Color Chart (1306). About two drops are usually required. Under some conditions, a precipitate will form shortly after *Manganese-Magnesium Test Solution #2 has been added. This will not effect the test reading. The test result is expressed in relative values of Magnesium from very low to very high. For approximate corresponding value in parts per million or pounds per acre, see page 19.

Calcium

Calcium deficiency is seldom a direct limiting factor in plant growth, because the lack of adequate calcium in a soil causes other growth limiting deficiencies to occur first. Calcium is the dominant cation in a soil's base or cation exchange complex; it prevents excessive soil acidity and stimulates beneficial biological activity. Low calcium levels may cause high soil acidity, diminishing the availability of some nutrients (like nitrogen) and permitting toxic levels of other minerals (like aluminum) to develop in the soil solution. In general, calcium plays an essential role in maintaining the chemical equilibrium of the soil solution.

This test measures the amount of calcium present in the base exchange complex. Calcium test results confirm and supplement soil acidity readings. Sandy soils normally contain less calcium than clay or organic soils. Sandy soils should give readings of approximately 500 ppm, clay soils 1000 ppm, and organic soils such as peats or forest loams 5000 ppm calcium. Lower levels in clay or organic soils indicate that the active calcium has been replaced by hydrogen or other ions, as in highly alkaline or highly acid soils.

PROCEDURE

1. Use a transfer pipet (0364) to transfer five drops of the general soil extract to a flat-bottomed glass turbidity vial (0242).
2. Add one drop of *Calcium Test Solution (5108PS). Swirl gently to mix.
3. Match the milky turbidity of the test sample against the turbidity standards on the Replaceable Calcium Chart (1303). Lay the chart flat under natural light and hold the turbidity vial one-half inch above the black strip in the middle of the chart. View the black strip down through the turbid sample and compare the resulting shade of gray with the six standard shades. The test result is read in parts per million replaceable calcium.
4. If the test sample turbidity corresponds to or exceeds the lightest standard (2800 ppm), repeat the test on a diluted sample. Transfer one drop of the general extract to a clean turbidity vial and add four drops of demineralized water. Then follow Steps 2 and 3 as above. Multiply the test result by 5 to obtain parts per million replaceable calcium.

Sulfate

Sulfur is essential to the formation of protein and affects various aspects of plant metabolism. Sulfur-deficient plants are pale green in color with thin, reedy stems. Negatively charged sulfate ions are easily leached. The major sources of soil sulfate are fertilizer containing sulfate compounds and atmospheric sulfur dioxide carried into the soil by precipitation.

PROCEDURE

1. Use a transfer pipet (0364) to transfer five drops of the general soil extract to a flat-bottomed turbidity vial (0242).
2. Add one drop of *Sulfate Test Solution (5171). Swirl gently to mix.
3. Compare the turbidity of the sample to the turbidity standards of the Sulfate Chart (1314). Lay the chart flat under natural light and hold the turbidity vial one-half inch above the black strip in the middle of the chart. View the black strip down through the turbid sample and compare the resulting shade of gray with the six standard shades. The test result is read in parts per million sulfate.

Aluminum

All soils contain significant amounts of aluminum in inorganic colloidal material and in the form of undecomposed minerals. In neutral, slightly alkaline, or slightly acid soils, this aluminum is in inert combinations that do not affect plant growth. In more acidic soils, aluminum can form soluble salts toxic to plant growth. A high test result indicates an undesirable acid soil. Plants which normally thrive on acid soils may fail on a soil with a high active aluminum test reading. A medium test result is generally tolerable—especially for grasses, corn, oats, potatoes, and tobacco. A low or negative aluminum test result is preferable.

PROCEDURE

1. Use a transfer pipet (0364) to transfer two drops of the general soil extract to one of the larger depressions on a spot plate (0159).
2. Add two drops of Universal Extracting Solution (5173).
3. Add one drop of *Aluminum Test Solution (5101).
4. Stir with a clean stirring rod (0519). Allow to stand for one minute.
5. Match the resulting color with the Active Aluminum Color Chart (1301). The test result is expressed in relative values of active aluminum from very low to very high. For approximate corresponding values in parts per million or pounds per acre, see page 19.

Chloride

Chlorides are present in practically all soils. Application of fertilizer may increase chloride levels. Chlorides are removed from the soil by leaching. Excessive concentrations are toxic to plants. A high test reading, particularly where stunted growth has been observed, may indicate poisoning due to high chloride levels in the soil.

PROCEDURE

1. Use the Demineralizer Bottle (1155) to fill a tube (0970-S) to the 5 mL line with demineralized water.
2. Use the 0.5 g spoon (0698) to add four level measures of the soil sample to the tube. Cap and shake vigorously for 2-3 minutes.
3. Use a piece of filter paper (0465) and a plastic funnel (0459) to filter the mixture into a second tube (0970-S). (Fold filter paper in half and then in half again to form a cone which is fitted into the funnel.)
4. Use a transfer pipet (0364) to transfer five drops of the filtrate in the second tube to a flat-bottomed turbidity vial (0242).
5. Add one drop of *Chloride Test Solution (5111) to the vial. Swirl gently to mix.
6. Match the turbidity or amount of precipitation against the turbidity standards on the Chloride Chart (1304). Lay the chart flat under natural light and hold the turbidity vial one-half inch above the black strip in the middle of the chart. View the black strip down through the turbid sample and compare the resulting shade of gray with the six standard shades. The test result is read in parts per million chloride.

Ferric Iron

The role of iron in plant nutrition is discussed in the *LaMotte Soil Handbook*. Iron is essential to the formation of chlorophyll, and iron deficiency causes chlorosis. While most soils contain abundant iron, only a fraction is soluble and readily available to the growing plant. This is particularly true in neutral or alkaline soils. Acid soils contain higher levels of available iron.

PROCEDURE

1. Use a transfer pipet (0364) to transfer four drops of the general soil extract to one of the larger depressions on a spot plate (0159).
2. Use the 0.05 g spoon (0696) to add one level measure of *Iron Reagent Powder (5275). Mix with a clean stirring rod (0519).
3. Add one drop of *Ferric Iron Test Solution (5116PS). Mix again.
4. Match the resulting color to the Ferric Iron Color Chart (1348). The test result is read in pounds per acre ferric iron.

Nitrite Nitrogen

Nitrites are formed as an intermediate step in the production of nitrates. Soils that are well drained and aerated contain only small amounts of nitrite nitrogen. Excessive nitrites, which are toxic to plants, may result from soil conditions unfavorable to the formation of nitrate, such as inadequate aeration. High nitrite readings may also be encountered in soils with large amounts of nitrates, where a portion of the nitrate nitrogen decomposes to form nitrites.

PROCEDURE

1. Use a transfer pipet (0364) to add 5 drops of soil extract to a large depression on a spot plate (0159).
2. Add 1 drop of *Nitrite Nitrogen Reagent 1 (5151WT).
3. Add 1 drop of *Nitrite Nitrogen Reagent 2 (5152WT). Mix with a clean stirring rod.
4. Add 3 drops of *Nitrite Nitrogen Reagent 3 (5153WT). Mix with a stirring rod. Wait 1 minute.
5. Match sample color to a color standard on the Nitrite Nitrogen Color Chart (1310). Record as ppm nitrite nitrogen.

6. If sample color matches, or is deeper than, the highest standard, repeat test on a diluted sample. Transfer one drop of soil extract to a large depression on a spot plate. Add 4 drops of *Universal Extracting Solution (5173). Follow Steps 2-5. Multiply final result by 5. Record as ppm Nitrite Nitrogen.

Ammonia Nitrogen

A fertile soil may be expected to give a low ammonia nitrogen test reading, unless there has been a recent application of nitrogenous fertilizer in forms other than the nitrate. The rapid disappearance of ammonia after fertilizer application indicates the desired transformation of the ammonia to the more available nitrate compounds. In forest soils ammonia is the most abundant available form of nitrogen. If there is a satisfactory rate of nitrogen transformation, the humus layers of a forest soil will produce very high concentrations of ammonia nitrogen.

PROCEDURE

1. Use a transfer pipet (0364) to transfer four drops of the general soil extract to one of the larger depressions on a spot plate (0159).
2. Add one drop of *Ammonia Nitrogen Test Solution (5103PS). Stir with a clean stirring rod (0519). Allow to stand for one minute.
3. Compare the resulting color against the Ammonia Nitrogen Color Chart (1302). The test result is expressed in relative values of ammonia nitrogen from very low to very high. For approximate corresponding values in parts per million or pounds per acre, see page 19.

Manganese

An essential element in the enzyme system of plants, manganese plays a role in metabolic reactions affecting germination, photosynthesis, and other vital aspects of plant development. Yellowing and stunted growth results from manganese deficiency. Some insoluble manganese is present in all soils. Its solubility or availability is closely related to soil pH. Calcareous soils or soils which have been heavily limed may be deficient in available manganese. Application of a soluble manganese salt, such as manganese sulfate, will correct this problem. Conversely, toxic levels of available manganese may develop in highly acid soils; this condition may be corrected by liming. Since available manganese may be leached from the soil or altered to less active forms by oxidation, this test should be conducted just prior to planting and during plant growth. Any positive test reading, even a very low reading, generally indicates the presence of sufficient available manganese to meet plant requirements. A high test reading is undesirable and indicates a need for liming.

PROCEDURE

1. Use a transfer pipet (0364) to add 10 drops of soil extract to the large depression on a spot plate (0159).
2. Use the 0.05 g spoon (0696) to add one measure of Manganese Buffer Reagent (6310). Mix with a clean stirring rod (0519) until the powder dissolves.
3. Use the other 0.05 g spoon (0696) to add one measure of *Manganese Periodate Reagent (6311). Mix with a clean stirring rod for 20 seconds.

   Note: The *Manganese Periodate Reagent will not dissolve completely.
4. Match the color in the spot plate to a color standard on the Manganese in Soil Color Chart (1307-01). Record as ppm Manganese.
   Note: Immediately clean the spot plate to prevent staining.

UNITS OF MEASURE

Test results are expressed in the following terms:

Parts per Million (ppm)	Pounds Per Acre (lb/acre)	Relative Amounts from Very Low to Very High
Nitrite Nitrogen	Nitrate Nitrogen	Ammonia Nitrogen
Calcium	Phosphorus	Magnesium
Sulfate	Potassium	Aluminum
Chloride	Iron	Manganese

Pounds per acre represent the number of pounds of soil in an acre to the plough depth of 6-7 inches, or 2,000,000 lbs. Conversion from pounds per acre to parts per million, or vice versa, may be accomplished by means of the following formulas:

ppm x 2 = lb/acre

lb/acre x 0.5 = ppm

In the four nutrient tests which produce relative test results, the following approximate quantitative values may be assigned to the relative terms:

Approximate Value Expressed in ppm

Test Factor	Very Low (Low)	Low (Medium Low)	Medium	High	Very High
Ammonia Nitrogen	5	10	40	100	150
Magnesium	5	10	25	80	150
Aluminum	5	10	30	80	125
Manganese	NA	5	12	25	40

FERTILIZER APPLICATION RATES

When interpreting soil test results to establish a fertilizer program, a number of variables must be considered in addition to the values obtained in the soil tests. These variables include the composition of the soil, drainage, climate, previous fertilizer programs and soil test results, and the type of plant to be grown. Consult local agricultural services for guidelines to fertilizer application rates for the specific soils in your area.

■ GREEN PLANT TISSUE TESTS

Testing an extract prepared from fresh plant tissue provides a means of verifying suspected nutrient deficiencies during plant growth. Plant tissue testing is discussed in the *LaMotte Soil Handbook*. The necessary information for testing nitrate nitrogen, phosphorus, and potassium in green plant tissues is given below.

These tests are meant to be used in a comparative manner. It is important to test tissue from healthy plants as well as those from problem plants. Interpretations should be based on comparison of test results from plants of the same species and same age, grown in the same general environment. Since test reactions may vary from species to species, at different stages of growth, or under different growing conditions, it is not possible to accurately quantify test results. The color charts should be used in a comparative manner. Relative values from very deficient to abundant have been assigned to the range of possible test reactions under each factor below.

PREPARATION of TISSUE EXTRACT

1. Select a small lot of the leaf petioles or succulent portion of the stem. When testing problem plants, collect tissue from those areas where the abnormality is most observable.
2. Use a clean, sharp knife or a razor blade to cut the material into fine bits not more than 1/8” to 1/16” in length and thickness.
3. Fill an Extraction Tube (0704) to the lower line with this material. Do not pack down.
4. Add *Universal Extracting Solution (5173PS) to the upper line. Cap and shake vigorously for five minutes.
5. Use a piece of filter paper (0465) and a plastic funnel (0459), filter the mixture into a second Extraction Tube (0704). This filtrate is the tissue extract to be used in place of the general soil extract in the nitrate nitrogen, phosphorus, and potassium test procedures.

PLANT TISSUE TEST PROCEDURE

Follow the soil test procedures for nitrate nitrogen, phosphorus, and potassium, using the tissue extract in place of the general soil extract. Remember that the color charts should only be used in a comparative manner, along with the relative values suggested. The most meaningful test results will be obtained from the comparison of healthy plant and problem plant test reactions.

Guidelines for Interpreting Plant Tissue Tests

Test Factor	Test Reaction	Relative Amount of Nutrient in Plant Tissue
Nitrate Nitrogen	Dark Pink Color	Abundant
	Light Pink Color	Adequate
	Colorless	No Reserve/Probably Deficient
Phosphorus	Deep Blue Color	Abundant
	Light Blue Color	Adequate
	Yellow to Colorless	Low to Deficient
Potassium	Heavy Precipitate	Adequate to Abundant
	Medium Precipitate	Low to Deficient
	Trace Precipitate	Deficient
	No Precipitate	Very Deficient

■ SOIL TEST REAGENTS

This information is provided to enable the soil analyst to correlate LaMotte soil test results with results obtained using other soil test procedures.

Soil Extraction Procedure The Universal Extracting Solution (5173) is composed of sodium acetate which has been adjusted to a pH of 4.8 with acetic acid. This solution extracts the soluble nutrients, such as phosphorus and nitrogen, as well as soluble and exchangeable potassium and other cations, such as calcium and magnesium.

Potassium Test The Potassium test is based on the fact that potassium salts give a yellow crystalline precipitate with sodium cobaltinitrite, *Potassium B Tablets (5161A). *Potassium Reagent C (5162) is denatured ethyl alcohol which facilitates the formation of the precipitate in more or less colloidal form.

Phosphorus Test Phosphates react with ammonium molybdate, *Phosphorus Reagent 2 (5156), to produce salts of a complex ammonium phosphomolybdate, which produce the blue molybdenum oxide color when reduced. Phosphorus Test Tablets (5706A), the reducing agent, are stannous chloride.

Nitrate Test The Nitrate test is based on the so-called Denige's test in which two dye intermediates are coupled in the di-azo reaction to form a color dyestuff. The nitrite required in this reaction is supplied by reduction of the nitrate in the soil extract. *Nitrate Reagent #1 (5146) is a solution of potassium acid sulfate. *Nitrate Reagent #2 Powder (5147) is a mixture of the two intermediates, N(1-naphthyl)-ethylene-diamine dihydrochloride and sulfanilamide; the reducing agent, which is zinc dust; and the filler, which is barium sulfate.

Humus Test In the humus test the disodium salt of ethylene diamine tetraacetic acid, *Humus Screening Reagent Powder (5119), extracts the dark colored humus fraction from the soil. This is measured against a special color comparator which has been calibrated to give a general relationship between this color and the content of organic matter.

Soil pH Test Sensitive short range pH indicators are used to measure the pH of a distilled water soil extract. Barium Sulfate is used to accelerate settling of the soil water mixture.

Calcium Test *Calcium Test Solution (5108PS) is sodium oxalate, which reacts with calcium to form a precipitate of Calcium Oxalate.

Ammonia Nitrogen Test *Ammonia Nitrogen Test Solution (5103PS) is Nessler's Reagent.

Magnesium Test The dye Titian Yellow, *Magnesium Test Solution 1 (5140), is absorbed on the precipitated magnesium hydroxide which is formed when *Magnesium and Manganese Test Solution #2 (5145WT), sodium hydroxide is added. The degree of color in the test reaction depends on the amount of precipitate formed.

Manganese Test Manganese is oxidized by the *Manganese Periodate Reagent (6311) to form permanganate.

Aluminum Test *Aluminum Test Solution (5101) is an alcoholic solution of hematein.

Nitrite Nitrogen Test *Nitrite Nitrogen Reagent 1 (5151WT) is hydrochloric acid. *Nitrite Nitrogen Reagent 2 (5152WT) is Lombard's Solution, which consists of sulfanilic acid, ammonium chloride, and phenol. *Nitrite Nitrogen Reagent 3 (5153WT) is sodium hydroxide.
A yellow dye is formed when nitrite is present.

Ferric Iron Test *Ferric Iron Test Solution (5116PS) is potassium thiocyanate, which reacts with iron to give the colored ferric thiocyanate.

Sulfate Test *Sulfate Test Solution (5171) is barium chloride, which reacts with sulfate to form the precipitate, barium sulfate.

Chloride Test Deionized water is used as the extracting solution. *Chloride Test Solution (5111) is silver nitrate, which reacts to form the precipitate, silver chloride.

Helping People Solve Analytical Challenges

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