

# POTASSIUM IN SOIL

Lab



CODE 5970

A unit of the LaMotte Classroom Studies Series

# TABLE OF CONTENTS

|                                      |    |
|--------------------------------------|----|
| Kit Contents . . . . .               | 3  |
| Safety . . . . .                     | 4  |
| After Testing . . . . .              | 4  |
| Organizing The Teams . . . . .       | 5  |
| Introduction . . . . .               | 7  |
| Testing Soil for Potassium . . . . . | 8  |
| Additional Experiments . . . . .     | 10 |
| Glossary . . . . .                   | 13 |
| Student Procedures . . . . .         | 14 |
| Reagent Composition . . . . .        | 16 |

# KIT CONTENTS

| Quantity  | Contents                        | Order Code |
|-----------|---------------------------------|------------|
| 250 mL    | Potassium Extracting Solution   | 5707-K     |
| 30 mL     | Potassium Indicator Tablets     | 5708-G     |
| 5 X 15 mL | Potassium Test Solution         | 5709-E     |
| 2 X 50 g  | Potassium Soil                  | 5715-H     |
| 5         | Color Chart, Potassium Endpoint | 5970-CC    |
| 10        | Test Tube, 1-8 mL, w/cap        | 0755       |
| 5         | Pipet, transfer                 | 0364       |
| 2         | Spoon, 0.5 g                    | 0698       |
| 1         | Manual                          | -----      |

**\* WARNING:** Reagents marked with an \* are considered hazardous substances. Material Safety Data Sheets (MSDS) are supplied for these reagents. For your safety, read label and accompanying MSDS before using.

To order individual reagents or test kit components, use the specified code number in the list. To order a complete refill for the kit, use code number R-5970.

# SAFETY

1

Follow the instructions. Read to the end of each procedure before starting the actual work. Measure samples and reagents accurately. Add the reagents in the order stated in the instructions. Observe the waiting times, when specified, for maximum color development.



2

Read reagent labels and Material Safety Data Sheets when supplied. Avoid contact between reagents and the skin and eyes. Additional information for all LaMotte reagents is available 24 hours a day from the Poison Control Center listed in the front of phone book. Each reagent can be identified by the four digit number listed in the upper left-hand corner of the reagent label, in the contents list and in the test procedures.



3

Cap reagent bottles after use to avoid contamination. Do not interchange caps. Store reagents in a cool, dry place.



4

Rinse test tubes and caps thoroughly in clean tap water after each use. Allow them to dry before putting them away.



5

Store equipment and reagents out of the reach of very young children.

6

Wear eye protection during the demonstrations. Wash hands after performing the experiments. When using materials not contained in this kit, be sure to follow the safety instructions on the container.



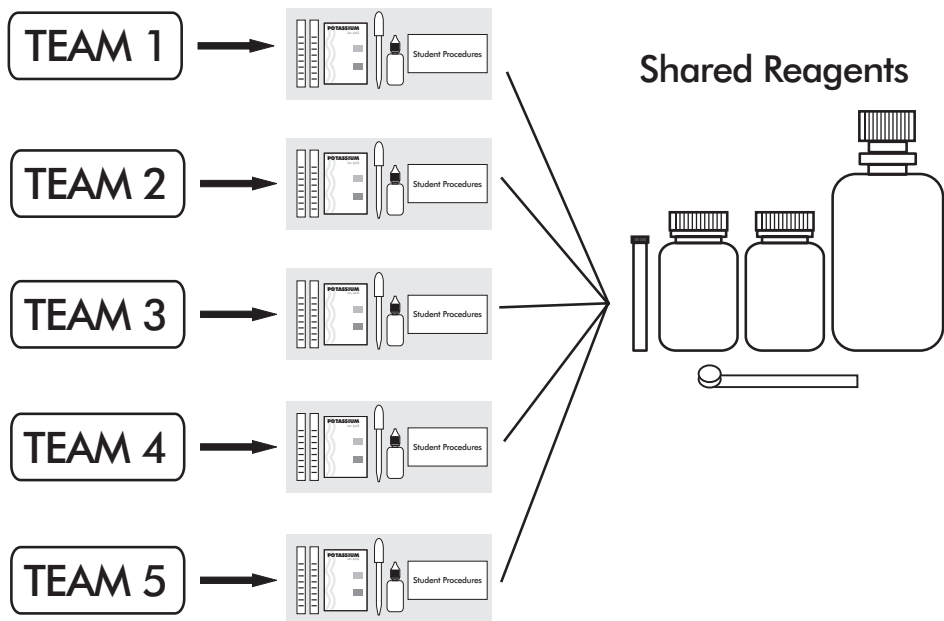
## After Testing

All reacted liquid samples can be poured down the drain with lots of running water. Dispose of treated soil samples in the trash.

# ORGANIZING THE TEAMS

Divide the group into 5 teams. Test tubes and apparatus are included for 5 teams to do a complete set of demonstrations at one time. There are enough reagents for the 5 teams to do 5 demonstrations each, or a total of 25 demonstrations. The teams will share one set of reagents.

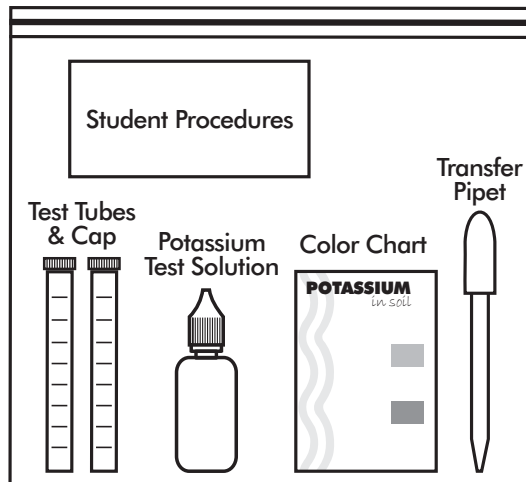
## Apparatus for One Demonstration



A set of items for each team can be collected ahead of time and packaged in a zipper-top bag. Each team will need:

|   |                                |         |
|---|--------------------------------|---------|
| 1 | Potassium Test Solution        | 5709-E  |
| 2 | Test Tubes                     | 0755    |
| 1 | Pipet                          | 0364    |
| 1 | Potassium Endpoint Color Chart | 5970-CC |
| 1 | Student Procedures             | -----   |

## For each team:



# INTRODUCTION

Plants need air, light, water and nutrients to grow. Some of the nutrients used by plants are found in the upper layers of the Earth's soil. Potassium is an important nutrient.

Most of the potassium in soil becomes available to plants very slowly. Weathering by wind and rain breaks rocks down into a form of potassium that is usable to plants. The potassium that is held by clay particles is slowly available to plants too. When potassium gets trapped between the clay particles, it is not available at all. Wood ashes and seaweed yields small but useful amounts of potassium.

Potassium dissolves in the water in the soil and then plants absorb it through their roots. The potassium solution travels up from the roots to the stem. It is then transported through tubes in the stem to other parts of the plant. When the potassium gets to the leaves, the plant uses it to take energy from sunlight and make food for the plant. This process is called photosynthesis. Potassium also plays a role in the manufacture of sugar and starch by plants.

Potassium controls the absorption of water and chemicals into plants that help them function efficiently. Plants that have enough potassium will have sturdy stems, be more resistant to disease and better able to survive freezing weather or droughts. Potassium is necessary for a healthy root system and new cell growth. Since new cells form at root tips and buds, potassium is important for root crops such as beets, potatoes, carrots, and radishes, and bud crops such as asparagus, broccoli, and cauliflower.

High levels of potassium are found in most soils but very little of it is available to plants. Large amounts of available potassium may cause the plant to become deficient in calcium and magnesium.

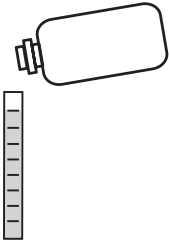
When plants don't get enough potassium, they won't grow properly. Their roots won't be correctly formed and their stems and stalks will be weak. Plants may be so weak that they will fall over as they grow. The weak plants are easily affected by bugs and diseases and they will not survive periods of freezing or drought. Plants with a potassium deficiency can be recognized by leaves that curl at the ends and look burnt and ragged around the edges.

# Testing Soil For Potassium

---


**1**

Fill a test tube (0755) to line 8 with \*Potassium Extracting Solution (5707).



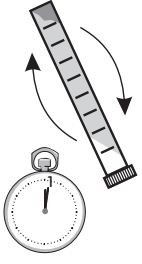
**2**

Use the 0.5g spoon to add two measures of Potassium Soil (5715).




**3**

Cap the tube and invert to mix gently for one minute.



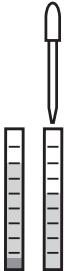
**4**

Place the tube on a flat surface and allow the soil particles to settle. Wait until the liquid above the soil becomes clear.




**5**

Use a pipet (0364) to transfer the clear liquid to a second test tube (0755) until it is filled to line 5. (Squeeze the air out of the pipet before you put it in the liquid and it won't suck up as much dirt.)



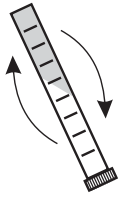
**6**

Add 1 Potassium Indicator Tablet (5708).



**7**

Cap the tube and invert to mix gently until the tablet disintegrates. The solution will turn purple if phosphorus is present.



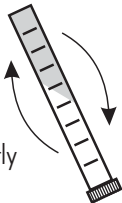


**8**

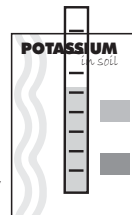
Carefully add 5 drops of Potassium Test Solution (5709).

**9**

Cap the tube and invert gently to mix.

**10**

Hold the tube against the white part of the Potassium Endpoint Color Chart (5970-CC). If the solution is blue and matches the endpoint color on the color chart, there is a very high level of potassium in the soil.

**11**

If the color of the solution is still purple, continue to add Potassium Test Solution, 5 drops at a time, mixing and comparing to the Endpoint Color Chart after every 5 drops, until the color is blue.

Number of Drops

Potassium Level

10 drops or less

High

10 to 20 drops

Medium

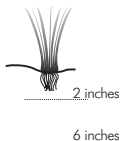
20 drops or more

Low

## Soil Sampling Tips



Take the soil sample from the root area of the plants that grow there. When sampling a lawn, take samples from the upper 2 or 3 inches of soil. When sampling a garden or farm crops, take the sample from the upper 6 to 8 inches of soil.



When testing a large area, take samples from several locations and mix them together to form a representative sample.



Use a clean trowel or knife to collect the samples.



Do not touch the soil with your hands unless it is necessary.



## ADDITIONAL EXPERIMENTS

If it is not necessary to do 25 demonstrations, the remaining reagents can be used to perform additional experiments. Try one or more of the following:

### Collecting Soil Samples

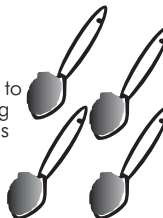
**1**

Clean the area of leaves and plants.



**2**

Collect 4 to 5 heaping teaspoons of soil.



**3**

Spread the soil on a clean piece of plastic or paper to dry. Allow the soil to dry for several hours or overnight. Do not bake the soil to dry.



**4**

Remove leaves, stones, roots and other foreign matter.



**5**

Crush big lumps with the back of a spoon.

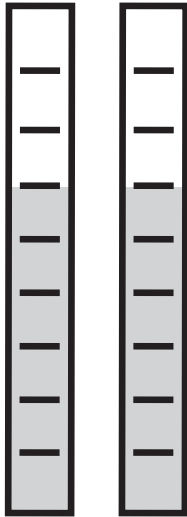


## Additional Experiments

---

### Test Your Own Soil

Follow the test procedure to test a soil sample from your garden, lawn or flowerpot.



### Potassium Effects

Collect soil samples from a variety of locations - lawns, vegetable gardens, flower pots, forests. Test the potassium level in each soil sample. Plant seeds in the soil samples and observe how different potassium concentrations affect growth.



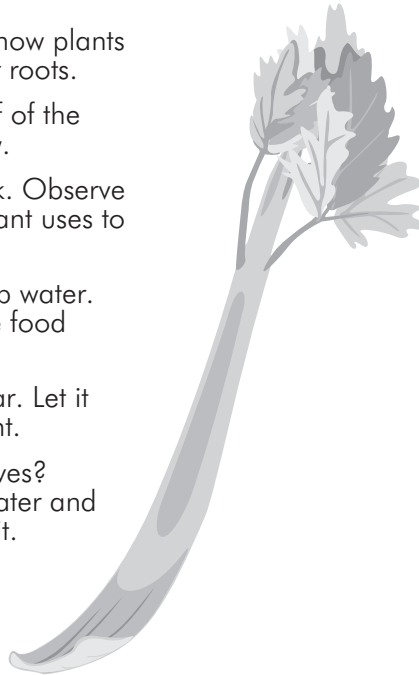
## Additional Experiments

---

### **Suck it up**

This activity will demonstrate how plants absorb nutrients through their roots.

1. Slice about half an inch off of the bottom of a piece of celery.
2. Look at the end of the stalk. Observe the tubes that the celery plant uses to absorb nutrients.
3. Fill a jar about 1/3 with tap water. Add 5 drops of red or blue food coloring.
4. Put the celery stalk in the jar. Let it soak up the water overnight.
5. What happened to the leaves?  
Take the stalk out of the water and look at the bottom of it.

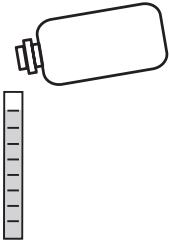

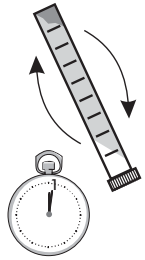



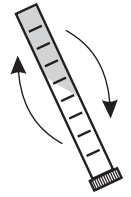


# GLOSSARY

|                            |   |
|----------------------------|---|
| <b>Absorb</b>              | Incorporation into the physical structure of a liquid or solid without chemical reaction.   |
| <b>Available nutrients</b> | Nutrients that are in a form that is capable of being assimilated by growing plants.  |
| <b>Drought</b>             | A time when water is not available to plants.   |
| <b>Nutrient</b>            | Any element taken in by a plant, essential to its growth and used by it to produce its food or tissue.  |
| <b>Photosynthesis</b>      | The process by which green leaves of plants, in the presence of sunlight, manufacture their own needed materials from carbon dioxide in the air and water and minerals taken from the soil. |
| <b>Root</b>                | The descending portion of a plant whose purpose is to penetrate the soil, absorb moisture and nutritional elements that will be converted into food by the leaves.                          |
| <b>Weathering</b>          | Physical or chemical changes caused in rocks, at or near the earth's surface, by atmospheric agents.  |

# Student Procedures • Potassium


Make a copy for each team.

|   |   |  |   |
|---|---|--|---|
| <p><b>1</b></p> <p>Fill a test tube (0755) to line 8 with *Potassium Extracting Solution (5707).</p>   | <p><b>2</b></p> <p>Use the 0.5g spoon to add two measures of Potassium Soil (5715).</p>  | <p><b>3</b></p> <p>Cap the tube and invert to mix gently for one minute.</p>   | <p><b>4</b></p> <p>Place the tube on a flat surface and allow the soil particles to settle. Wait until the liquid above the soil becomes clear.</p>  |
| <p><b>5</b></p> <p>Use a pipet (0364) to transfer the clear liquid to a second test tube (0755) until it is filled to line 5. (Squeeze the air out of the pipet before you put it in the liquid and it won't suck up as much dirt.)</p>  | <p><b>6</b></p> <p>Add 1 Potassium Indicator Tablet (5708).</p>                          | <p><b>7</b></p> <p>Cap the tube and invert to mix gently until the tablet disintegrates. The solution will turn purple if phosphorus is present.</p>  |   |

# Student Procedures • Potassium


Make a copy for each team.

**8**



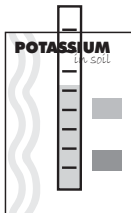
Carefully add 5 drops of Potassium Test Solution (5709).

**9**



Cap the tube and invert gently to mix.

**10**



Hold the tube against the white part of the Potassium Endpoint Color Chart (5970-CC). If the solution is blue and matches the endpoint color on the color chart, there is a very high level of potassium in the soil.

**11**

If the color of the solution is still purple, continue to add Potassium Test Solution, 5 drops at a time, mixing and comparing to the Endpoint Color Chart after every 5 drops, until the color is blue.

| <u>Number of Drops</u> | <u>Potassium Level</u> |
|------------------------|------------------------|
| 10 drops or less       | High                   |
| 10 to 20 drops         | Medium                 |
| 20 drops or more       | Low                    |

What level of Potassium was in the soil?

---

# REAGENT COMPOSITION

- Potassium Extracting Solution (5707) is a dilute solution of sodium acetate and acetic acid.
- Potassium Indicator Tablets (5708) are a mixture of sodium tetraphenylboron and bromphenol blue. Sodium tetraphenylboron reacts with potassium in the soil extract.
- Potassium Test Solution (5709) is a standardized quaternary ammonium chloride solution. This solution is added to the soil extract and indicator tablet mixture. The amount of the reagent required to change the color from purple to light blue measures the amount of tetraphenylboron that has previously combined with the potassium in the soil extract.
- Potassium Soil (5715) is a natural soil sample enriched with potassium.

## Color Chart Equivalents

|        |                   |
|--------|-------------------|
| Low    | 0-120 lb/acre     |
| Medium | 120-200 lb/acre   |
| High   | above 200 lb/acre |

