April 2007: 30 Days of Green

SUNDAY MONDAY TUESDAY WEDNESDAY THURSDAY FRIDAY SATURDAY

April is National Garden Month® — When you garden, you GROW!

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April 11

Sorting Out SOIL

Give students a chance to become soil surgeons and create their own "mudshakes!"

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background

Plants grow all over the world in different climates and environments, but they all have the same basic needs: water, light, air, and nutrients. Soil plays a big role in fulfilling the basic needs of most plants. What is soil? It's a combination of minerals, organic matter (decaying plant and animal material), and pore space (open space that holds air and water). Here's how soil provides some of a plant's basic needs.

Water

Plants need water for a number of important processes, including photosynthesis (production of food) and transpiration (evaporation of water from the leaves into air that cools the plant and creates pressure to move water from roots to leaves). Water also aids in the absorption of some nutrients. Approximately 90 percent of a plant's weight is water, so it is vital that a plant is able to replenish what is lost or used each day. Most plants take up the water they need from the soil by absorbing it through their roots.

Light

Plants capture energy from light to fuel photosynthesis (the process by which they make their food). Plants are the only organisms with the ability to produce their own food and for this reason they are the foundation of every food chain. So, as you can see, all life depends on light captured by plants.

Although soil doesn't directly provide this basic need, it does provide a place for plants to anchor themselves, so they can stand upright and unfold their leaves to the light.

Air

Plants need air. They use the carbon dioxide in the air during photosynthesis, and they use the oxygen in the air during respiration. Yes, plants respire: they burn oxygen to fuel metabolic functions. Fortnately for us, they produce more oxygen during photosynthesis than they consume during respiration!

The above-ground parts of plants are exposed to air all the time, but roots also need air and the soil must provide this. When the soil stays wet for too long, plant roots are deprived of oxygen

activity

In addition to anchoring plants in the ground, soil contains life-sustaining water and nutrients which plants absorb through their roots. Plants grown in the soil to which they are adapted will perform better and be less susceptible to pests and diseases.

Give your students a chance to become "soil surgeons." Collect numerous soil samples to analyze and compare.

Texture refers to the way soil feels and holds together, and it is primarily determined by the blend of sand, silt, and clay particles in the sample.

One way to test texture is to create "mudshakes" and then observe how the soil particles settle out. For each soil sample, have students fill a clear container about two-thirds full of water, then add enough soil to nearly fill the jar. Also add a pinch of powdered laundry detergent to help the soil components separate well. Shake the jar vigorously, then set it

and begin to suffocate and die.

Nutrients

Like animals, plants require certain nutrients. The nutrients plants need in large quantities are called macronutrients and include nitrogen, phosphorus, potassium, sulfur, calcium, and magnesium. Nutrients plants need in smaller quantities are called micronutrients. These include iron, zinc, copper, molybdenum, boron, manganese, chlorine, and nickel.

Though we often say we're "feeding" our plants when we fertilize, that's not quite accurate. When we fertilize plants we are providing them with the nutrients they need so they can manufacture their own food (carbohydrates) by the process of photosynthesis. You can think of these nutrients as similar to the vitamins and minerals we get from supplements. They allow us to carry out all the various metabolic functions necessary for good health.

Plants get some of their nutrients from the air, including carbon, hydrogen, oxygen, and sometimes nitrogen. But they get all other nutrients from the soil or from fertilizers. These nutrients are dissolved in the water contained in the soil and plants take them up through their roots.

Healthy Soil = Healthy Plants

The majority of garden plants prefer soil rich in organic matter that has a balanced blend of air space, water holding capacity, and drainage. Gardeners separate the mineral content of soil into three main categories: sand, silt, and clay. These particles are derived from rock that has been broken down over thousands of years by climatic and environmental conditions. Soil is characterized by the different amounts of these three particles. For instance, if the soil is mostly sand particles, the soil will be loose and will drain quickly. In contrast, if there are a lot of clay particles, the soil will drain slowly, and may be hard and compacted.

Some soils are better able to supply plants' basic needs than others. For instance, sandy soils tend to be low in nutrients. Clay soils contain more nutrients, but these are sometimes bound up in forms unavailable for plants. Understanding their soils' characteristics helps gardeners provide misssing nutrients.

Testing Basic Needs

To test these plant needs, see how plants respond in the absence of one of these key needs. For instance, try to grow a plant without water, or place a plant in a closet without light. Keep in mind that the needs of plants vary by type (e.g., cacti need little water, but vegetable plants generally need a lot). Plants are adapted to the basic conditions available to them in their native environment (the place they originally grew). That doesn't mean they can't grow in another environment, it just means they are adapted to certain conditions and grow best in places that provide those conditions.

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Over the course of the next couple of days, observe how the particles settle into layers. Ask students to hypothesize about the composition of the different layers. The larger particles (gravel and sand) are heaviest and will settle at the bottom, followed by silt, and then clay. The clay may stay suspended and cloud the water for a long time. Organic matter will float on or just below the water surface. Measure the depth of the total particle components and that of each layer, and then translate that into percentages for each component (depth of each component divided by the depth of the total soil sample).

Next, investigate the **nutrient content** of the soil using a do-it-yourself soil test kit. These are available at garden stores and from garden supply catalogs. They usually test for the three nutrients plants need in the largest quantities — nitrogen, phosphorus, and potassium — and acidity, or pH.

What do the results say about your soil's nutrient content? Does your soil contain enough nutrients to support healthy plant growth? Will you need to supplement your soil with additional nutrients by adding fertilizer or compost?

You can confirm the results of your soil tests by sending of samples to a local soil lab. Check with your county or regional Cooperative Extension office for more details.