What is Growing Media?

In this lesson, students will be able to:

- Identify several types of growing media
- Explore the types of growing media with their senses
- Create an artificial growing media to solve a particular plant's needs

Materials Needed:

Approximately 2 cubic feet of each of the following:

- Sphagnum/Peat Moss
- Sand
- Vermiculite
- Perlite
- Calcined Clay
- Composted Bark
- Coir
- Rockwool (only a few cubes of rockwool necessary)

15 ice cream buckets
15 cups
7 sandwich bags

Time to Complete:

Activity – Part 1 = 25 minutes

Activity – Part 2 = 25 minutes

Introduction

Growing media can be any structure that plant roots reside in. Traditional field crops use field soil as their growing medium – commonly called soil. In the landscape/nursery world, growing media can take on a variety of forms and be made of one or more components that help support the plant. This lesson will explore several of those components.

Field soil is traditionally made up of various percentages of sand, silt, and clay. In many cases, field soil also contains **organic matter.** A **soilless media** is quite different from a field soil. Soilless media is often an artificial growing environment that balances the nutritional and structural needs of the plants.

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Growing Media vs. Field Soil

Field soil becomes easily compacted in containers and is not recommended

- Comprised of sand, silt, and clay
- Various amounts of organic matter
- Heavy with a high bulk density
- Modification is an option
    - Adding some type of soilless media to increase aeration and drainage (i.e. sand, composted bark, etc.)

Soilless media commonly used in container production

- A combination of several soilless media components is often mixed together to achieve the ideal amount of nutrition, water hold capacity, and aeration
    - Improved drainage and aeration:
        - Sand, perlite, vermiculite, calcined clay, polystyrene beads
    - Increased water retention:
        - Peat moss, perlite, vermiculite, coir
    - Increased bulk density:
        - Sand, calcined clay
    - Decreased bulk density:
        - Perlite, vermiculite, polystyrene beads

Exploring the Components

Sphagnum/Peat Moss

Formed in very wet conditions where the organic matter (water plants, mosses, and algae) maintain a high level of acidity and nutrient availability for plants

- Sphagnum Moss – a type of moss that when dried can be used as a soilless media component
- Peat moss – a type of sphagnum moss that has been accumulated and condensed into a more compact form

- High in organic matter
- Holds 10-20 times its weight in water
- Decomposes very slowly
- Good **aeration** until decomposition breaks down the fibers
- pH between 3.5-4.5
- Lightweight

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Sand
Formed from eroded and broken-down rock particles. Graded based on particle size and used for different uses such as concrete, soil modification, and foundation construction.

1. Based on the grain size of the particle, sand is classified as fine sand (0.075 to 0.425mm), medium sand (0.425 to 2mm), and coarse sand (2.0 mm to 4.75mm)
2. Based on origin, sand is classified as pit sand, river sand, sea sand, and manufactured sand.

(*https://cementconcrete.org/*)

- Inorganic
- No nutrient availability
- Low **cation-exchange capacity** (CEC)
- Excellent aeration and drainage
- pH is variable (depends on source)
- Heavy weight (≈100 lbs/cubic foot)

Vermiculite
Formed from expanded mica, a volcanic rock. The mica is heated to about 2000°F and during this heating process it puffs up into layers of rock. These layers make the vermiculite very capable of holding high water-holding capacity.

1. Graded based on the size of the vermiculite particles
    a. No. 1 – insulation grade (largest)
    b. No. 2 – regular horticultural grade
    c. No. 3 – intermediate size
    d. No. 4 – component of commercial mixes for seed germination (smallest size)
2. Insulation grade vermiculite CANNOT be used for horticultural purposes

- Inorganic
- Contains trace amounts of Magnesium (Mg) and Potassium (K)
- High water-holding capacity
    - Approximately 1 liter of water per 3 liters of volume of vermiculite
- Excellent aeration and drainage
- pH of 7.0 or higher
- Good buffering capacity
- Light weight (6-10 lbs./cubic foot)

Perlite
Formed from a volcanic rock heated to 1400-1600°F. This causes the perlite to pop like popcorn into a lightweight rounded substance that crushes under pressure.

<u>Perlite dust is carcinogenic. Always wear a respirator when mixing or handling dry perlite.</u>

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- Inorganic
- Contains up to 200 ppm of Fluoride (F)
    - Fluoride is toxic to many plants and will often show as burnt leaf tips
- High water-holding capacity
- Excellent aeration and drainage
- pH between 6.0 and 8.0
- No buffering capacity
- Light weight (6 lbs./cubic foot)

Calcined Clay
Montmorillonite clay processed and baked at high temperatures. Often used on sports fields and areas with high traffic. Can be used in growing media to add weight to the mixture.

- Inorganic
- No nutrient value but capable of absorbing nutrients
- Moderate water-holding capacity
    - Highly porous
- Excellent aeration and drainage
- pH between 5.0 and 6.0
- Resistant to breaking down
- Heavy weight (30-40 lbs./cubic foot)

Composted Bark
Composting helps destroy injurious/inhibiting compounds, increases cation exchange, and reduces/eliminates insects, diseases, organisms, nematodes, and weed seeds.

- High in organic matter with slow decomposition
- High in carbon creating a C:N ratio around 300:1
- Moderate water retention
- Moderate nutrient holding capacity
- pH between 6.0 and 6.5
- Variable weight (10-40 lbs./cubic foot)
- Particle sizes:
    - 10 mm or less – preferred for pot mixes
    - 10-19 mm – preferred for additions to cut flower beds in greenhouses
    - Over 20 mm – preferred for landscape mulches

Coir
Made from the by-products of the coconut industry. Coir is the fibers from the middle layer (mesocarp) of the coconut husk and is sometimes called coir dust or coir fiber pith.

- High in organic matter with slow decomposition
- Moderate in carbon creating a C:N ratio around 80:1

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- High water holding capacity
    - Up to 8 times the volume of water to volume of coir
- Low nutrient holding capacity
    - May contain high levels of potassium and other soluble salts
        - Leaching of the product can reduce the toxicity of these salts
- pH between 5.0 and 6.5
- Light weight (3-5 lbs./cubic foot)

Rockwool

Rockwool is created from melted volcanic rock (limestone, basalt, and slag) spun like cotton candy. This rock melts at approximately 2900°F.

- Inorganic and non-biodegradable
- Up to 90% pore space
- Moderate water-holding capacity
- No nutrient-holding capacity
- pH between 7.0 and 8.5
- Available in slabs, cubes, and granular forms
- **Horticultural grade must be used**
    - Contains surfactant to help with water absorption
    - Insulation grade and acoustical grade is NOT acceptable for horticultural use

Soilless Media Preparation

To eliminate harmful organisms such as weed seed, bacteria, and fungus, soilless media can be pasteurized.

- Pasteurization
    - Mechanical
        - Solarization
            - The use of transparent or white polyethylene sheets secured to the soil surface
            - May take several weeks or months
        - Steam
            - Internally injecting steam into the soilless media
            - Media must reach 180°F for 30 minutes
            - Beneficial organisms can survive this temperature
    - Chemical
        - Chemical applications to the soilless media can combat organisms
        - Always read and follow the label
- Sterilization
    - Soilless media sterilization is not recommended as this makes the growing environment very unwelcome for plants
    - Soilless media temperatures reaching 212°F kills all organisms – good and bad alike

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Activity – Part 1

This activity is an exploration of soilless media components.

Directions: A sample of each of the soilless media types will be passed around for sensory exploration. You may touch, smell, and look at all the sample (except the perlite – **do not smell the perlite as it is harmful to your lungs**). Write your observations down about each soilless media type. Answer the question: *what surprised you about each one?*

Sphagnum/Peat Moss

Calcined Clay

Sand

Composted Bark

Vermiculite

Coir

Perlite

Rockwool

Reflection

What did you already know when we started this activity?

What did you learn from this activity?

What surprised you the most about this activity?

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Activity – Part 2

This activity allows students to explore the needs of a specific plant and to create an artificial soil "recipe" using proportions.

Directions: You will be working in small groups of no more than three students. Your group will be assigned to one of the following plants: strawberry, hydrangea, and lavender. Within your group, use Google to determine what the plant's soil needs are. Use the information about soilless media components to make a "recipe" for your assigned plant.

After completing the recipe, use the cups to select the proper amount of each soilless media component and dump those components into your group bucket. Once the recipe is complete, mix the new soilless media product up with your hands.

Your group will share your recipe and allow the other groups to look at and touch your soilless media.

Soilless Media Recipe

Assigned Plant: _____

_____ part(s) Sphagnum/Peat Moss

_____ part(s) Perlite

_____ part(s) Sand

_____ part(s) Composted Bark

_____ part(s) Vermiculite

_____ part(s) Coir

_____ part(s) Calcined Clay

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Activity Add-ons

Plant the seeds and see what happens!

Let students explore how their mix might potentially hold up against a potting soil mix bought in the store.

What does each component cost?

Let students explore the cost of buying in bulk and determining what their recipe would cost in bulk.

Does the proportion of components affect plant growth?

Let students design a growing experiment to test the different proportions of a recipe.

Reflection

What did you already know when we started this activity?

What did you learn from this activity?

How will this activity help you grow plants?

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