Moisture-Holding Capacity of Soil

Lesson Plan: NRES B2-8
Anticipated Problems

1. What is moisture-holding capacity?
2. What primary factor determines how much moisture a soil can hold?
3. How do you determine the amount of moisture a soil profile can hold?
Terms

- available soil moisture
- available waterholding capacity
- capillary moisture
- gravitational moisture
- hygroscopic moisture
- infiltration
- leaching
- moisture-holding capacity
- percolation
- permeable
- soil moisture tension
- unavailable soil moisture
Moisture-Holding Capacity

- **Moisture-holding capacity** is the ability of the soil within a soil profile to retain water.
  - Water accounts for about 25% of an average soil.
  - It occupies part of the pore space in the soil.
  - When it rains, water enters the soil or flows off the soil’s surface.
Infiltration & Percolation

- The process of water soaking into the soil is known as *infiltration*.
- Once water is in the soil, it moves downward in a process known as *percolation*.
Permeable

A quality soil allows both kinds of water movement and is said to be *permeable*. Water in the soil may be one of three types:

- Gravitational
- Capillary
- Hygroscopic
Three Types of Moisture

Gravitational moisture (Superfluous Water)

Capillary moisture (Plant Available Water)

Hygroscopic moisture (Unavailable Water)

FIGURE 2. Three types of moisture found in soils.
Gravitational Moisture

- *Gravitational moisture* is the water that moves downward through the soil as a result of gravity.
  - It may help replenish groundwater supplies.
  - It is also available to plants.
Leaching

- Gravitational water flows quickly through soil that has large pores and slowly through soil that has small pores.

  □ As water moves through the soil, it carries dissolved minerals, chemicals, and salts.

  □ This loss of water-soluble nutrients, chemicals, and salts from the soil is referred to as *leaching*. 
Capillary Moisture

- **Capillary moisture** is the water held within the pore spaces between soil particles against the forces of gravity.
  - It is available to plants.
  - It may move upward or sideways by capillary action.
  - Clay soils hold more capillary water than sandy soils because they have more pore spaces.
Hygroscopic Moisture

- **Hygroscopic moisture** is the water that tightly clings to the soil particles.
  - It forms a thin film around individual soil particles.
  - This moisture is usually unavailable to plants.
  - Water may be available or unavailable for plant use.
Available Moisture

- **Available soil moisture** is the water in the soil that can be used by plants.
  - When moisture levels are high, plants can easily extract moisture from the soil.
  - As the water is used, soil moisture tension increases. **Soil moisture tension** is the force by which soil particles hold on to moisture.
Hygroscopic Moisture

Hygroscopic moisture has high soil moisture tension. Although the water is present in the soil, it is considered *unavailable soil moisture* for plant use.
Soil with high organic-matter content and good structure permits water absorption.

Hard-packed surface soil plus impermeable subsoil prevents absorption.

Rock layer prevents water from soaking deeply into soil.

FIGURE 1. Permeable soil allows water to infiltrate and percolate.
How Much Moisture?

- Moisture-holding capacity is determined primarily by the soil’s texture.
  - As a rule, the finer the texture of the soil, the more moisture it will hold.
  - A soil with a high percentage of sand holds less water than one with a low percentage of sand.
How Much Moisture?

- Water percolates rapidly through the large pore spaces created by sand.
  - Plants growing in sandy soils experience water stress more quickly than those growing in loam and clay soils.
Soils with a high percentage of clay hold water and keep it from percolating out of the root zone.

□ Some of the water is held too tightly for plant use.
□ This means less water is available to plants than if silt were present.
□ A good silt loam holds the most moisture available for plants.
Available Water-Holding Capacity

- The amount of moisture a soil can hold for plants is referred to as available water-holding capacity.
THE AMOUNTS OF AVAILABLE AND UNAVAILABLE WATER INCREASE AS THE CLAY CONTENT OF SOIL INCREASES.
Available Water-Holding Capacity

Available water-holding capacity depends on:

1. How deep the soil profile is.
2. The type of soil texture found throughout the soil profile.
Moisture Per Inch of Soil

On average, each of the following textures will hold the designated amount of moisture per inch of soil:

- Fine textured—0.20 inches of water
- Moderately fine textured—0.25 inches of water
- Medium textured—0.30 inches of water
- Moderately coarse textured—0.20 inches of water
- Coarse textured—0.10 inches of water
Calculate Water-Holding Capacity

To determine the available water-holding capacity for a given area:

1. Multiply the depth of each horizon, to a maximum depth of 60 inches, by the amount of water the texture within that horizon can hold

2. Add the totals of all the horizons to calculate total water-holding capacity.
Review

- What is term for the process of water soaking into the soil?
- What are the three types of moisture in soil?
- What is the primary factor that determines moisture-holding capacity of soil?